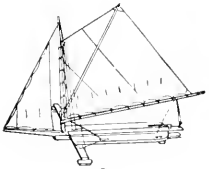
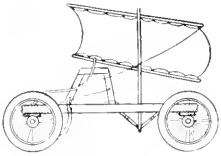


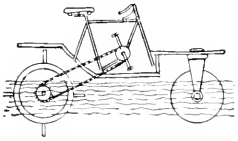
Ice Boat

A Book for Boys



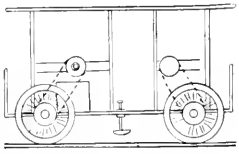
Sailing Bicycle

BOATS, WATER MOTORS, WIND MILLS, SEARCHLIGHT, ELECTRIC BURGLAR ALARM, ICE BOAT, WATER BICYCLE, CABINS, CAMPS, CLOCKS, FISHING TACKLE, KITES, IMITATION STREET CAR LINE, ETC.



Water Bicycle

POPULAR MECHANICS
CHICAGO



Street Car

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CHICAGO
POPULAR MECHANICS

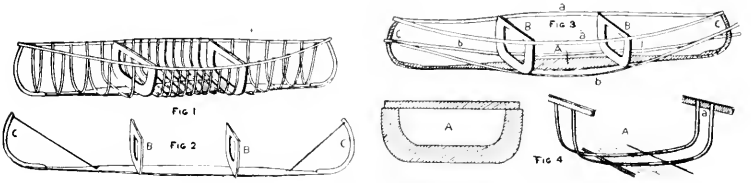
The Paper Boat Is Light and Easy to Propel

HOW TO MAKE A PAPER BOAT

A Light Boat That Can Be Easily Carried

Now you might think it absurd to advise making a paper boat, but it is not, and you will find it in some respects and for some purposes better than the wooden boat. When it is completed you will have a canoe, probably equal to the Indian's bark canoe. Not only will it serve as an ideal fishing boat, but when you want to combine hunting and fishing you can put your boat on your shoulders and carry it from place to place wherever you want to go and at the same time carry your gun in your hand. The material used in its construction is inexpensive and can be purchased for a few dollars.

Make a frame (Fig. 1) on which to stretch the paper. A board 1 in. thick and about 1 ft. wide and 11½ ft. long is used for a keel, or backbone, and is cut tapering for about a third of its length, toward each end, and beveled on the outer edges (A, Fig. 2). The cross-boards (B, B, Fig. 2) are next sawed from a pine board 1 in. thick. Shape these as shown by A, Fig. 1, 13 in. wide by 26 in. long, and cut away in the center to avoid useless weight. Fasten them cross-wise to the bottom-board as shown in Fig. 1 and 2, with long stout screws, so as to divide the keel into three nearly equal parts. Then add the stem and stern pieces (C, C, Fig. 2). These are better, probably, when made of green elm. Screw the pieces to the bottom-board and bend them, as shown in Fig. 2, by means of a string or wire, fastened to a nail driven into the bottom. Any tough, light wood that is not easily broken when bending will do. Green wood is preferable, because it will retain the shape in which it has been bent better after drying. For the gunwales (a, a, Fig. 3), procure at a carriage factory,



Details of Framework Construction

or other place, some light strips of ash, $\frac{3}{8}$ in. thick. Nail them to the cross-boards and fasten to the end pieces

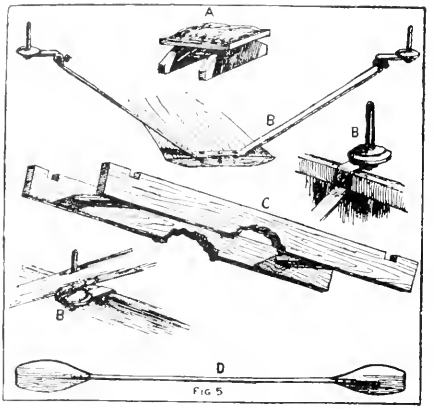


FIG. 5

Important Features of Construction

(C, C,) in notches, by several wrappings of annealed iron wire or copper wire, as shown in Fig. 3. Copper wire is better because it is less apt to rust. For fastening the gunwales to the crossboards use nails instead of screws, because the nails are not apt to loosen and come out. The ribs, which are easily made of long, slender switches of osier willow, or similar material, are next put in, but before doing this, two strips of wood (b, b, Fig. 3) should be bent and placed as in Fig. 3. They are used only temporarily as a guide in putting in the ribs, and are not fastened, the elasticity of the wood being sufficient to cause them to retain their position. The osiers may average a little more than $\frac{1}{2}$ in. in thickness and should be cut, stripped of leaves and bark and put in place while green and fresh. They are attached to the bottom by means of shingle nails driven through holes previously made in them with an awl, and are then bent down until they touch the strips of ash (b, b, Fig. 3), and finally cut off even with the tops of the gunwales, and notched at the end to receive them (B, Fig. 1). Between the cross-boards the ribs are placed at intervals of 2 or 3 in., while in other parts they are as much as 5 or 6 in. apart. The ribs having all been fastened in place as described, the loose strips of ash (b, b, Fig. 3) are withdrawn and the framework will appear somewhat as in Fig. 1. In order to make all firm and to prevent the ribs from changing position, as they are apt to do, buy some split cane or rattan, such as is used for making chair-bottoms, and, after soaking it in water for a short time to render it soft and pliable, wind it tightly around the gunwales and ribs where they join, and also interweave it among the ribs in other places, winding it about them and forming an irregular network over the whole frame. Osiers probably make the best ribs, but twigs of some other trees, such as hazel or birch, will answer nearly as well. For the ribs near the middle of the boat, twigs 5 or 6 ft. long are required. It is often quite difficult to get these of sufficient thickness throughout, and so, in such cases, two twigs may be used to make one rib, fastening the butts side by side on the bottom-board, and the smaller ends to the gunwales, as before described. In drying, the rattan becomes very tight and the twigs hard and stiff.

The frame-work is now complete and ready to be covered. For this purpose buy about 18 yd. of very strong wrapping-paper. It should be smooth on the surface, and very tough, but neither stiff nor very thick. Being made in long rolls, it can be obtained in almost any length desired. If the paper be 1 yd. wide, it will require about two breadths to reach around the frame in the widest part. Cut enough of the roll to cover the frame and then soak it for a few minutes in water. Then turn the frame upside down and fasten the edges of the two strips of paper to it, by lapping them carefully on the under side of the bottom-board and tacking them to it so that the paper hangs down

loosely on all sides. The paper is then trimmed, lapped and doubled over as smoothly as possible at the ends of the frame, and held in place by means of small clamps. It should be drawn tight along the edges, trimmed and doubled down over the gunwale, where it is firmly held by slipping the strips of ash (b, b) just inside of the gunwales into notches which should have been cut at the ends of the cross-boards. The shrinkage caused by the drying will stretch the paper tightly over the framework. When thoroughly dry, varnish inside and out with asphaltum varnish thinned with turpentine, and as soon as that has soaked in, apply a second coat of the same varnish, but with less turpentine; and finally cover the laps or joints of the paper with pieces of muslin stuck on with thick varnish. Now remove the loose strips of ash and put on another layer of paper, fastening it along the edge of the boat by replacing the strips as before. When the paper is dry, cover the laps with muslin as was done with the first covering. Then varnish the whole outside of the boat several times until it presents a smooth shining surface. Then take some of the split rattan and, after wetting it, wind it firmly around both gunwales and inside strip, passing it through small holes punched in the paper just below the gunwale, until the inside and outside strips are bound together into one strong gunwale. Then put a piece of oil-cloth in the boat between the cross-boards, tacking it to the bottom-board. This is done to protect the bottom of the boat.

Now you may already have a canoe that is perfectly water-tight, and steady in the water, if it has been properly constructed of good material. If not, however, in a few days you may be disappointed to find that it is becoming leaky. Then the best remedy is to cover the whole boat with unbleached muslin, sewed at the ends and tacked along the gunwales. Then tighten it by shrinking and finally give it at least three coats of a mixture of varnish and paint. This will doubtless stop the leaking entirely and will add but little to either the weight or cost.

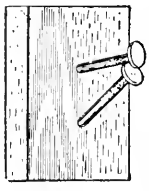
Rig the boat with wooden or iron rowlocks (B, B, Fig. 5), preferably iron, and light oars. You may put in

Off for a Hunt

several extra thwarts or cross-sticks, fore and aft, and make a movable seat (A, Fig. 5.) With this you will doubtless find your boat so satisfactory that you will make no more changes.

For carrying the boat it is convenient to make a sort of short yoke (C, Fig. 5), which brings all the weight upon the shoulders, and thus lightens the labor and makes it very handy to carry.

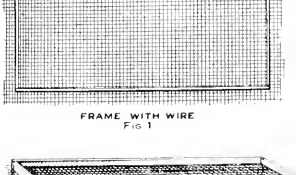
To Hang Heavy Things on a Nail



Boys will find many places around the house, where a hook to hang things on will be a great convenience. Instead of buying hooks use wire nails, and if driven as shown in the cut, they will support very heavy weights. Drive the lower nail first.

A Home-Made Elderberry Huller

As we had only one day to pick elderberries, we wanted to get as many of them as we could in that time. We could pick them faster than they could



FRAME WITH WIRE
Fig. 1

END
Fig. 5

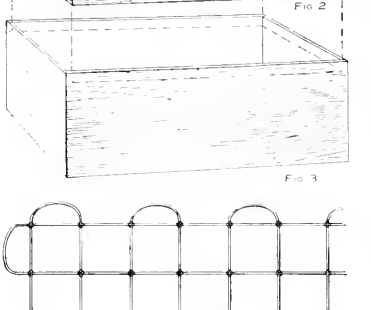
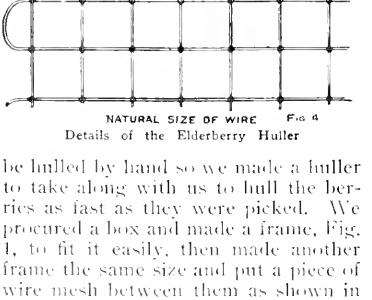


Fig. 2

Fig. 3



NATURAL SIZE OF WIRE Fig. 4

Details of the Elderberry Huller

be hulled by hand so we made a huller to take along with us to hull the berries as fast as they were picked. We procured a box and made a frame, Fig. 1, to fit it easily, then made another frame the same size and put a piece of wire mesh between them as shown in Fig. 2, allowing a small portion of the mesh to stick out of the frames. The top frame would keep the berries from rolling or jumping off, and the bottom frame kept the wire mesh and frame from being shaken off the box. The projecting edges of the mesh would keep the frame on the top edge of the box. The top view of the frame is shown in Fig. 1 and the end in Fig. 5, and the box on which the frame rests in Fig. 3. The actual size of the wire mesh used is shown in Fig. 4. One person could hull with this huller as many berries as two persons would pick.—Contributed by Albert Niemann, Pittsburg, Pa.

How to Make a Bulb on a Glass Tube

As a great many persons during the winter months are taking advantage of the long evenings to experiment in one way or another, the following method of forming bulbs on glass tubes may be of interest. A common method is to heat the part to be formed and by blowing in one end of the tube gradually expand the glass. This way has its drawbacks, as many are not sufficiently familiar with the work to blow a uniform blast, and the result is, a hole is blown through the side of the tube by uneven heating or blowing.

A good way to handle this work, is to take the tube and 1 or 2 in. more in length than the finished article is to be and place one end over an alcohol flame, and by holding a spare piece of tubing against the end allow them both to come to a melting heat, then pull apart and instead of breaking off the long thread thus formed, simply hold it in the flame at an angle of 45 deg. and melt it down and close the end at the same time. Close the other end with the same operation; this makes the tube airtight.

Gradually heat the tube at the point where the bulb is to be formed, slowly turning the tube to get a uniform heat. The air inside of the tube becoming heated will expand, and the glass, being softer where the flame has been applied, will be pushed out in the shape of a bulb. A great deal of care should be taken not to go to extremes, as the bulb will burst with a loud report if the heat is applied too long. The best results are obtained by heating the glass slowly and then the bulb can be formed with regularity. This is an

easy way to make a thermometer tube. After the bulb is formed, the other end of the tube can be opened by heating, drawing out and breaking the thread like glass.—Contributed by A. Oswald.

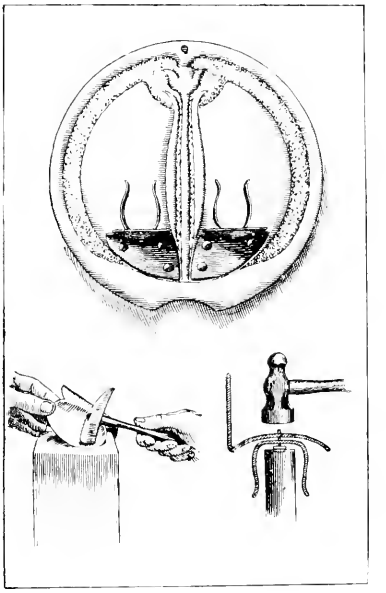
How to Make a Sconce

A sconce is a candlestick holder, so made that it has a reflector of brass or copper and is to hang upon the wall. The tools necessary are a riveting hammer, file, metal shears, rivet punch, flat and round-nosed pliers, screwdriver and sheet brass or copper No. 23 gauge.

To make the sconce proceed as follows: First, cut off a piece of brass so that it shall have $\frac{1}{2}$ in. extra metal all around; second, with a piece of carbon paper, trace upon the brass lines that shall represent the margin of the sconce proper, also trace the decorative design; third, with a nailset make a series of holes in the extra margin about $\frac{3}{4}$ in. apart and large enough to take in a $\frac{3}{4}$-in. thin screw; fourth, fasten the metal to a thick board by inserting screws in these holes; fifth, with a twenty-penny wire nail that has had the sharpness of its point filed off, stamp the background of the design promiscuously. By holding the nail about $\frac{1}{4}$ in. above the work and striking it with the hammer, at the same time striving to keep its point at $\frac{1}{4}$ in. above the metal, very rapid progress can be made. This stamping lowers the background and at the same time raises the design. Sixth, chase or stamp along the border of the design and background using a nail filed to a chisel edge. This is to make a clean sharp division between background and design. Seventh, when the stamping is complete remove the screws and metal from the board and cut off the extra margin with the metal shears. File the edges until they are smooth to the touch.

The drip cup is a piece of brass cut circular and shaped by placing the brass over a hollow in one end of a block. Give the metal a circular motion, at the same time beat it with a round-nosed mallet. Work from the center along concentric rings outward, then reverse.

The candle holders may have two, three, four, or six arms, and are bent to shape by means of the round-nosed pliers. The form of the brackets which support the drip cups may be seen in the illustration.



Completed Sconce

Shaping the Holder. Riveting

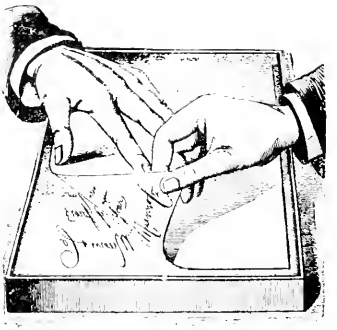
Having pierced the bracket, drip cup, and holder, these three parts are riveted together as indicated in the drawing. It will be found easier usually if the holder is not shaped until after the riveting is done. The bracket is then riveted to the back of the sconce. Small copper rivets are used

It is better to polish all the pieces before fastening any of them together. Metal polish of any kind will do. After the parts have been assembled a lacquer may be applied to keep the metal from tarnishing.

How To Make a Hectograph

A hectograph is very simply and easily made and by means of it many copies of writing can be obtained from a single original.

Make a tray of either tin or paste-



Making Copies with the Hectograph

board, a little larger than the sheet of paper you ordinarily use and about ½ in. deep. Soak 1 oz. of gelatine in cold water over night and in the morning pour off the water. Heat 6½ oz. of glycerine to about 200 deg. F. on a water bath, and add the gelatine. This should give a clear glycerine solution of gelatine.

Place the tray so that it is perfectly level and pour in the gelatinous composition until it is nearly level with the edge of the tray. Cover it so the cover does not touch the surface of the composition and let it stand six hours, when it will be ready for use.

Make the copy to be reproduced on ordinary paper with aniline ink; using a steel pen, and making the lines rather heavy so they have a greenish color in the light. A good ink may be made of methyl violet 2 parts, alcohol 2 parts, sugar 1 part, glycerine 4 parts, and water 24 parts. Dissolve the violet in the alcohol mixed with the glycerine; dissolve the sugar in the water and mix both solutions.

When the original copy of the writing is ready moisten the surface of the hectograph slightly with a sponge, lay the copy face down upon it and smooth down, being careful to exclude all air bubbles and not shifting the paper. Leave it nearly a minute and raise one corner and strip it from the pad, where will remain a reversed copy of the inscription.

Immediately lay a piece of writing paper of the right size on the pad, smooth it down and then remove as before. It will bear a perfect copy of the original. Repeat the operation until the number of copies desired is obtained or until the ink on the pad is exhausted. Fifty or more copies can be obtained from a single original.

When through using the hectograph wash it off with a moist sponge, and it will be ready for future use. If the surface is impaired at any time it can be remelted in a water bath and poured into a tray as before, if it has not absorbed too much ink.

How to Make a Sailomobile

By Frank Mulford, Shiloh, N. J.

I had read of the beach automobiles used on the Florida coast; they were like an ice boat with a sail, except they had wheels instead of runners. So I set to work to make something to take me over the country roads.

I found and used seven fence pickets for the frame work, and other things as they were needed. I spliced two rake handles together for the mast, winding the ends where they came together with wire. A single piece would be better if you can get one long enough. The gaff, which is the stick to which the upper end of the sail is fastened, is a broomstick. The boom, the stick at the bottom of the sail, was made of a rake handle with a broomstick spliced to make it long enough. Mother let me have a sheet, which I put down on the floor and cut in the shape of a mainsail. The wind was the cheapest power to be found, thus it was utilized; the three wheels were cast-off bicycle wheels.

I steer with the front wheel, which was the front wheel of an old bicycle

with the fork left on. The axle between the rear wheels is an iron bar which cost me 15 cents, and the pulley

Sailomobile for Use on Country Roads

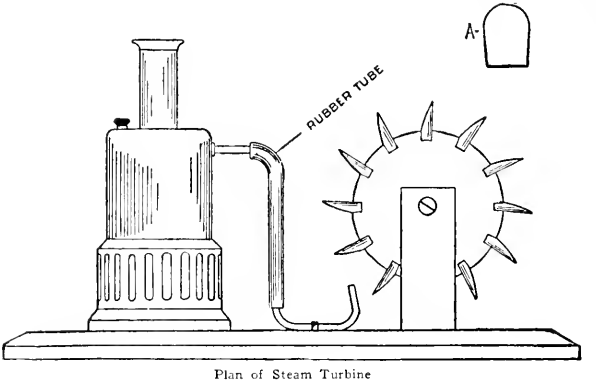
which raises and lowers the sail cost 5 cents. Twenty cents was all I spent, all the rest I found.

A saw, hammer, and brace and bit were the tools used. Slats made the seat and a cushion from the house made it comfortable, and in a week everything was ready for sailing.

Once it was started with only my little cousin in it and I had to run fast to catch up.

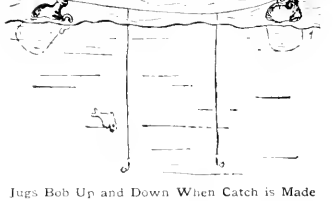
Jug Line Fishing

Jug line fishing is fine sport and often successful where other methods fail. It is more often used on rivers on account of the current. Fasten two jugs to a strong line about 30 ft. long. Be sure that each jug is securely corked.



Plan of Steam Turbine

To the long line attach a couple or more of short fish lines equipped with proper sinkers and baited hooks. This done, place the outfit in the water and watch it, ready to follow with a row boat, or let it float down stream attached to a line held in the hand. When one of the jugs sinks or commences to bobble, you can row out to the line and



Jugs Bob Up and Down When Catch is Made

pull in the fish. On the Mississippi river dozens of jugs are often thus tied together and the fisherman follows them in a row boat until he has a good boat load of fish.

How to Make a Miniature Steam Turbine

With an old toy steam engine boiler and a little work a steam turbine can easily be made. When you have the boiler the next thing to do is to make a disk of wood about ¼ in. thick and 3½ in. in diameter. Mark twelve points around the edge of the circle of wood, the points being at equal intervals all the way around. Cut with a fine saw 3/16 in. at each of these points. Twelve paddles should then be made of sheet copper or brass and cut in the shape of the figure shown at A in the sketch. Then wedge the paddles tightly into the saw cuts and bend them into the shape of a spoon. For the axle take a wire nail, cut off the head and sharpen each end to a fine point. Force the nail securely into a central hole in the disk.

Now we may go back to the boiler. As there is generally a small piece of brass tubing left on the side of a boiler, which was formerly connected to the steam engine, this piece may now be joined to a 4 or 5 in. length of rubber tubing and bound with wire. The rubber pipe is then attached in the same manner to a piece of metal tube bent into the shape shown in the drawing and fastened to the base with a staple.

In mounting the wheel make two blocks of wood each 3 in. high, ½ in. thick and 1 in. wide. On the flat end of one of the blocks screw a small plate of sheet brass and punch a very tiny hole which should fit the point of the axle. For the opposite bearing file off the point of a 1-in. screw and also make a small hole in the end of this to fit

the other point of the axle. Then put the screw into the second block at the same height as the hole in the piece of brass on the first block. Fasten these bearings to a base made of a board 1 ft. long and 6 in. wide. A fairly good idea of the way the wheel is to be mounted may be obtained from the sketch.

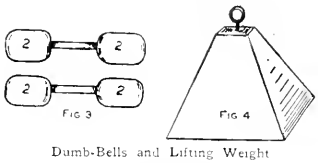
The turbine is now complete and ready to run. Heat is obtained from an alcohol lamp or Bunsen burner and when under full steam the wheel will revolve with considerable rapidity.—Contributed by E. H. Klipstein, East Orange, N. J.

How to Make a Pair of Dumb-Bells

Any boy can make a pair of dumb-bells for himself and a lifting weight, also, which will do quite as well as any he could purchase, providing he does his work carefully.

First procure two large tin cans, such as fruit is often canned in, and cut the ends out of each. Shape four round pieces of wood just large enough to fit tightly in the ends of the cans and then cut a hole in the center of each piece of wood as shown in Fig. 1. Procure, also, a hardwood bar the length of the ordinary dumb-bell—a length of old broom handle will do very well.

For filling the cans mix 1 part of cement with 2 parts of sand and add water until it is soft, but still has a degree of firmness. Pack this closely into the cans and insert the wooden disks into the ends of the cans. Insert the hardwood bar through the holes in the inside disks so that it runs clear through the center of each can of cement, and joins the cans with a proper length of rod between (Fig. 2). It is well to first string the two inner disks on the bar and then drive a few nails through each end of it before pushing into the cement, to give it a grip. The disks are then pushed along the rod to fit into the open end of each can. Put a wedge in each end of the can to hold the bar in place. The other dumb-bell is made in the same manner.



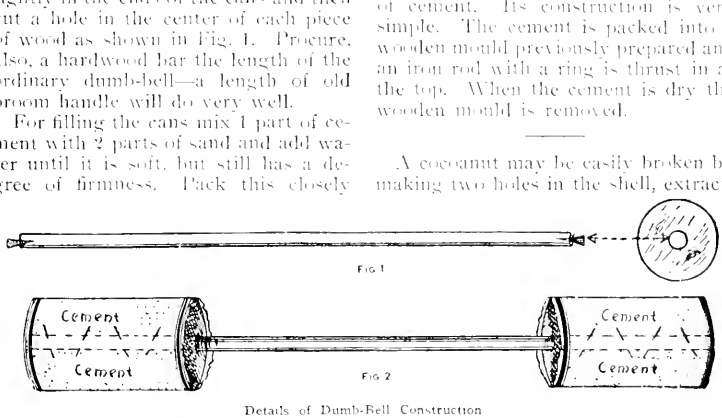
Dumb-Bells and Lifting Weight

At this stage let the bells stand for five days or until the cement is perfectly dry, then remove bits of wood and tin until only the cement is left. Cement dumb-bells may be filed into shape as in Fig. 3, and painted, also, if desired.

Figure 4 shows a lifting weight made of cement. Its construction is very simple. The cement is packed into a wooden mould previously prepared and an iron rod with a ring is thrust in at the top. When the cement is dry the wooden mould is removed.

A cocoanut may be easily broken by making two holes in the shell, extracting the milk, applying air pressure by blowing in the holes and quickly throwing it to the floor.

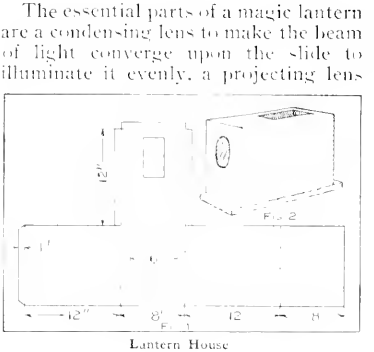
Never change a single ball in a bearing. Renew them all.



Details of Dumb-Bell Construction

A Home-Made Magic Lantern

The essential parts of a magic lantern are a condensing lens to make the beam of light converge upon the slide to illuminate it evenly, a projecting lens



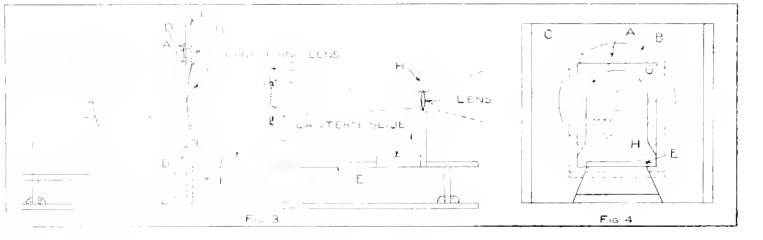
Lantern House

with which to throw an enlarged picture of the illuminated slide upon a screen and some appliances for preserving the proper relation of these parts to each other. The best of materials should be used and the parts put together with care to produce a clear picture on the screen.

The first to make is the lamp house or box to hold the light. Our illustration shows the construction for an electric light, yet the same box may be used for gas or an oil lamp, provided the material is of metal. A tin box having dimensions somewhere near those given in the diagrammatic sketch may be secured from your local grocer, but if such a box is not found, one can be made from a piece of tin cut as shown in Fig. 1. When this metal is bent at right angles on the dotted lines it will form a box as shown in Fig. 2 which is placed on a baseboard, ½ to ¾ in. thick, 8 in. wide, and 14 in. long. This box should be provided with a reflector located just back of the lamp.

Procure a plano-convex or a bi-convex 6-in. lens with a focal length of from 15 to 20 in. and a projecting lens 2 in. in diameter with such a focal length that will give a picture of the required size, or a lens of 12-in. focus enlarging a 3-in. slide to about 6 ft. at a distance of 24 ft.

The woodwork of the lantern should be of ½-in., well seasoned pine, white wood or walnut and the parts fastened together with wood screws, wire brads, or glue, as desired. The board in which to mount the condensing lens is 16 in. wide and 15 in. high, battened on both ends to keep the wood from warping. The board is centered both ways, and, at a point 1 in. above the center, describe a 9-in. circle with a compass and saw the wood out with a scroll or keyhole saw. If a small saw is used, and the work carefully done, the circular piece removed will serve to make the smaller portion of the ring for holding the condensing lens. This ring is made up from two rings, A and B, Fig. 3. The inside and outside diameters of the ring B are ⅜ in. greater than the corresponding diameters of ring A, so when fastened together concentrically an inner rabbet is formed for the reception of the lens and an outer rabbet to fit against the board C in and against which it rotates being held in place by buttons, DD



Magic Lantern Details

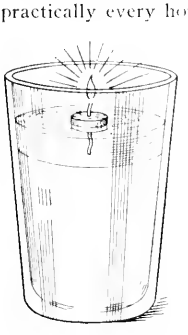
A table, E, about 2 ft. long is fastened to the board C with brackets F and supported at the outer end with a standard. The slide support, G, and the lens slide, H, are constructed to slip easily on the table, E, the strips II serving as guides. Small strips of tin, JJ, are bent as shown and fastened at the top and bottom of the rectangular opening cut in the support G for holding the lantern slides.

All the parts should be joined together snugly and the movable parts made to slide freely and when all is complete and well sandpapered, apply two coats of shellac varnish. Place the lamphouse on the bottom board behind the condensing lens and the lantern is ready for use.

The proper light and focus may be obtained by slipping the movable parts on the board E, and when the right position is found for each, all lantern slides will produce a clear picture on the screen, if the position of the lantern and screen is not changed.—Contributed by Stuart Mason Kerr, St. Paul, Minn.

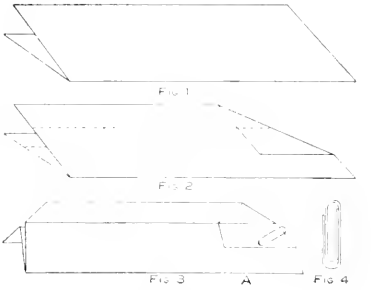
A Quickly Made Lamp

A very simple lamp can be made from materials which are available in practically every household in the following manner: A cheap glass tumbler is partly filled with water and then about ½ in. of safe, light burning oil, placed on the water. Cut a thin strip from an ordinary cork and make a hole in the center to carry a short piece of wick. The wick should be of such a length as to dip into the oil, but not long enough to reach the water. The upper surface of the cork may be protected from the flame with a small piece of tin bent over the edges and a hole punched in the center for the wick. The weight of the tin will force the cork down into the oil. The level of the oil should be such as to make the flame below the top of the tumbler and the light then will not be blown out with draughts. The arrangement is quite safe as, should the glass happen to upset, the water at once extinguishes the flame.—Contributed by G. P. B.



How to Make a Paper Aeroplane

A very interesting and instructive toy aeroplane can be made as shown in the accompanying illustrations. A sheet



Folding the Paper

of paper is first folded, Fig. 1, then the corners on one end are doubled over, Fig. 2, and the whole piece finished up and held together with a paper clip as in Fig. 3. The paper clip to be used should be like the one shown in Fig. 4. If one of these clips is not at hand, form a piece of wire in the same shape, as it will be needed for balancing purposes as well as for holding the paper together. Grasp the aeroplane between the thumb and forefinger at the place marked A in Fig. 3, keeping the paper as level as possible and throwing it as you would a dart. The aeroplane will make an easy and graceful flight in a room where no air will strike it.—Contributed by J. H. Crawford, Schenectady, N. Y.

Banana oil or amyl acetate is a good bronze liquid.

How to Make Your Own Fishing Tackle

If you want to fish and engage in some other sport at the same time, you

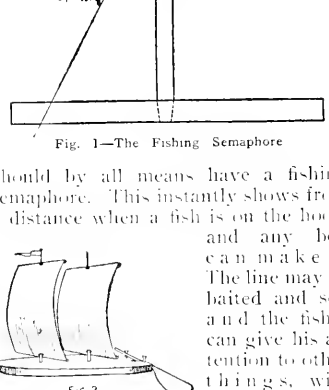


Fig. 1—The Fishing Semaphore

should by all means have a fishing semaphore. This instantly shows from a distance when a fish is on the hook, and any boy can make it. The line may be baited and set, and the fisher can give his attention to other things, with only an occasional glance at the signal. To make the semaphore take a piece of board about 12 in. square and 2 in. thick. If a single piece cannot be obtained, build a block of this size out of small stuff. Bore a hole in the center 1 in. in diameter and drive a piece of timber 2 in. square and 12 or 15 in. long into it. Now take a piece of wood 2 in. wide and 5 in. long for the semaphore and round two of the corners, as shown in the cut. Bore a small hole 2½ in. from the tapered end and fasten the board to the scantling by

Fig. 2
Toy Fishing Boat

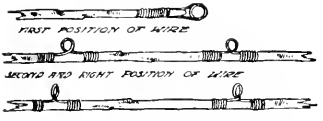


Fig. 3—Method of Making a Trout Rod

driving a small round nail at A (Fig. 1). Drive another nail at B, leaving the nail head protrude ½ in. from the upright to serve as a rest for the semaphore. The board should be made to turn easily on the pivot nail. At C fasten a strip of thin sheet iron, bent flat at the top, so as to support the semaphore in place when it is sprung—that is, when it rises to indicate a fish is caught. The free end of this strip or spring rests on the outside of the semaphore when it is down, and supports it when it is up. It should not press too tightly against the signal. At D drive a small nail and attach the fishing line. When the fish takes the hook it will throw the signal up to a horizontal position and the spring C will hold it there. The semaphore may be painted red, or white, or to bear the word "Fish."

Bass and pickerel have an irresistible hankering for bait on a hook trolled by toy boats. These boats serve the purpose, however rudely made, and one boy can operate a whole fleet of them, if he has a large boat by which he can row to any one of the small boats immediately when he notes a fish is hooked. The boats can be made of a piece of plank, say 2½ ft. long. The board should be sharpened at one end and rigged up with a couple of cloth masts (Fig. 2). The most important part of the craft is the rudder. This should be very long, to prevent the boat from making leeway and to keep it from changing its course. Drive a couple of nails in the stern of the boat, to which tie the fish lines, hooked with spoon or live bait. The small boat does not scare the fish as a large one does, and the bait pulled along by it is wonderfully attractive to members of the finny tribe, especially when trolled before the wind.

If proper fishing tackle is not accessible, it is very easy to manufacture it yourself. To make a trout rod first secure a long, straight, elastic pole, such as can be found in nearly any wood. Then secure some pins and a small piece of wire. File off the heads of the pins and bend them in the shape of the letter U and drive them in the rod on the same side at regular intervals, be-

ginning at about 2½ ft. from the butt end of the pole. Drive the pins just far enough in to permit the line to pass freely under the loop. To make the tip bend a circular loop in the center of a piece of wire and knot or bind the wire to the end of the pole, as shown in the illustration (Fig. 3). If you have plenty of wire, it will make better loops than the pins. Cut the wire into short pieces about 3 in. long, loop each piece in the center. Then with more wire or with strong, waxed thread, bind the ends lengthwise on the rod, as shown in the illustration (Fig. 3). After the binding is secure, twist each loop around to its proper position.

A large wooden spool, an old tin can and a thick wire will serve to make an A1 reel. Run the wire through the spool and wedge it tightly so that 1 in. protrudes at one end and 3 in. at the other. From a tin can cut a piece of tin of the shape shown in Fig. 1. Two protruding parts are left on each side to be bent up for side pieces, to serve as rests for the axle. After the side pieces are bent up in the proper shape, punch a hole in each and insert the ends of the wires through the holes. See that the spool revolves freely, and then bend the long end of the wire in the shape of a crank. Hammer the tin over the rod until it takes the exact curve of the rod and fits snugly. Then bind it firmly to the rod with strong twine. It is difficult to make a fish

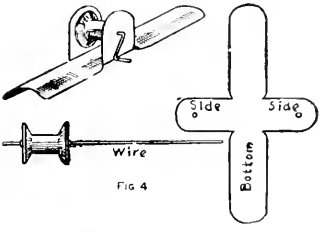


Fig. 4

How the Reel Is Made

hook, though many good perch and cats have been caught with bent pins. A strong steel wire can be bent and filed to a point and a notch filed above the point for the barb. Fish hooks have been made of birds' claws. The claw is bound to a piece of shell by vegetable fiber. None of these home-made hooks are satisfactory, however,

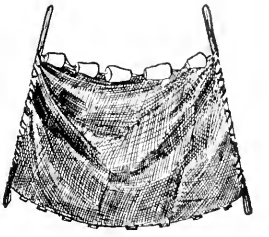


Fig. 5

Simple Minnow Net

and it is better to carry a good supply with you. Inside the hat band is a good place to carry small hooks.

Live minnows are the best bait for black bass, pickerel and many other kinds of fish, and to catch live minnows you need a net. One of the simplest minnow nets is made by fastening two sticks to the ends of a stout

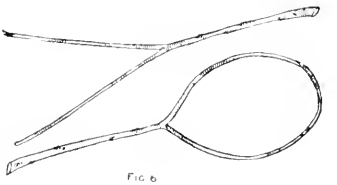


Fig. 6

Frame for a Scoop Net

piece of mosquito bar. If desired, the net may be provided with floats at the top edge and sinkers at the bottom, as in the illustration (Fig. 5). Old sieves and pieces of meshed wire can often be transformed into ideal minnow nets.

A good landing net may be made from a forked stick and a piece of strong mosquito bar, or preferably a ball of twine. Bend the two ends of the fork until the ends overlap each other and bind them tightly together, as shown in the cut (Fig. 6). Waxed twine serves best in all such binding work in making reels, nets and other tackle. Now, if the net is to be made

of mosquito bar, sew the mosquito bar into the shape of a bag and fasten the mouth to the sides of the loop described by the connected forks of the stick. A better net is made from twine. Fasten

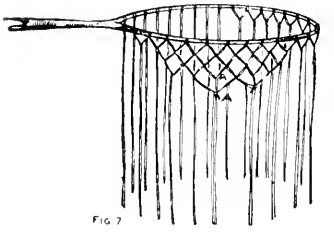


FIG 7
Weaving the Scoop Net

the pole in a handy place, with the hoop suspended vertically a little higher than your neck. Cut a number of pieces of twine each about 8 ft. long. Double each piece and slip it on the loop with the loose ends hanging down. Arrange the double strings this way all around the loop. Now begin from a convenient point, take a string from each adjoining pair and make a simple knot of them, as shown in the diagram (Fig. 7). Continue all the way around the loop, knotting the strings together in this manner. Now begin on the next lower row, and so on until a point is reached where you believe the net ought to commence to narrow or taper down. This is accomplished by knotting the strings a little closer together and cutting off one string of a pair at four equidistant points in the same row. Knot as before until you come to a clipped line; here take a string from each side of the single one and knot them, being careful to make it come even with others in the same row. Before tightening the double knot pass

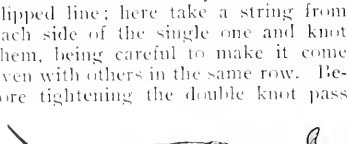


FIG 9
How to Fasten a Minnow on a Hook

the single string through, and after tying a knot close to the double one, cut the string off close as at A.

Continue as before until the row is finished, only changing from the first plan when a single string is reached. Proceed in the same manner with the next and the next rows, diminishing the number of strings remaining until the remaining ones meet at the bottom. Be careful not to let one drop mesh come directly under another of the same kind.

A bucket or old tin can with the top and sides perforated by means of a nail and hammer (Fig. 8), will serve as a minnow bucket. The illustration (Fig. 9) shows the proper way to bait a hook with a live minnow. The cartilaginous mouth of the minnow has little or no feeling in it, and when thus baited the minnow is not killed and swims about promiscuously, thus standing a much better chance of catching a fish than when cruelly mangled by the hook of the ignorant fisherman.

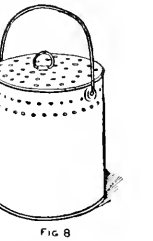


FIG 8
Minnow Bucket

How to See Through Your Hand

Roll a tube out of a piece of pasteboard about 5 in. square, having one end just large enough to fit around the eye and the other slightly smaller. Take the tube between the thumb and finger of the right hand and put the large end close against the right eye. Hold your left hand against the other end of the tube and keep both eyes open. There will appear to be a hole through your hand and objects beyond it will be plainly visible. The left eye is actually doing all the seeing of objects beyond, but it will seem like the right eye sees them, too, through the hand.

Always put a washer on a lag-screw before turning it into the wood.

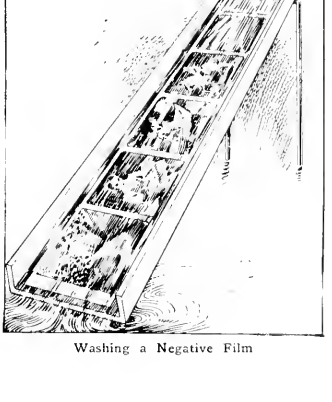
It is not economy to save emery wheels by neglecting to keep them true and sharp.

A Film Washing Trough

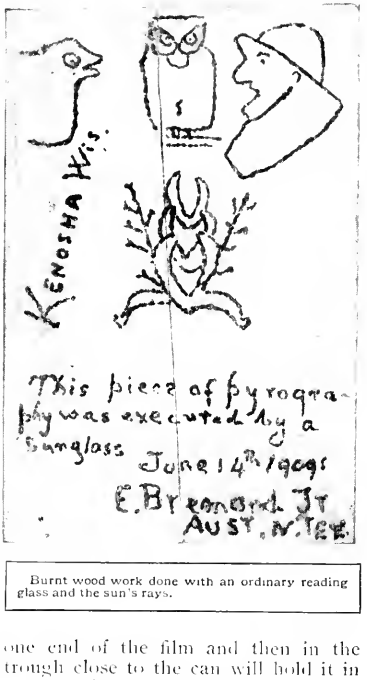
The washing of films without scratching them after they are developed and fixed is very difficult in hot weather. A convenient washing trough for washing full length films is shown in the accompanying sketch. The trough must be made for the size of the film to be washed. Cut a ¾-in. board as long as the film and a trifle wider than the film's width. Attach strips to the edges of the board to keep the water from spilling over the sides.

Cut a hole in one side of a baking-powder can about half way between the top and bottom, large enough to admit a fair-sized stream of water from a faucet. Then solder the cover to the can and punch a number of holes about ¼ in. apart along the opposite side from where the large hole was cut. Place this can on one end of the trough, as shown, with the large hole up.

Some heavy wire bent in the shape of a U and fastened to the under side of the trough at the can end will furnish supports to keep that end of the trough the highest and place the opening in the can close beneath the water faucet. A common pin stuck through one end of the film and then in the trough close to the can will hold it in position for washing. Five minutes' washing with this device is sufficient to remove all traces of the hypo from the film.—Contributed by M. M. Hunting, Dayton, O.



Washing a Negative Film



Burnt wood work done with an ordinary reading glass and the sun's rays.

The Diving Bottle

This is a very interesting and easily performed experiment illustrating the transmission of pressure by liquids. Take a wide-mouthed bottle and fill almost full of water; then into this bottle place, mouth downward, a small vial or bottle having just enough air in the bottle to keep it barely afloat. Put a sheet of rubber over the mouth of the large bottle, draw the edge down over the neck and wrap securely with a piece of string thus forming a tightly stretched diaphragm over the top. When a finger is pressed on the rubber

the small bottle will slowly descend until the pressure is released when the

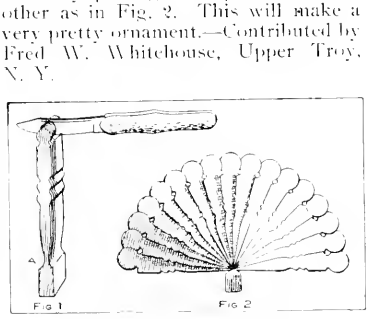
Pressure Experiments

small bottle will ascend. The moving of the small bottle is caused by the pressure transmitted through the water, thus causing the volume of air in the small tube to decrease and the bottle to descend and ascend when released as the air increases to the original volume.

This experiment can be performed with a narrow-necked bottle, provided the bottle is wide, but not very thick. Place the small bottle in as before, taking care not to have too much air in the bottom. If the cork is adjusted properly, the bottle may be held in the hand and the sides pressed with the fingers, thus causing the small bottle to descend and ascend at will. If the small bottle used is opaque, or an opaque tube such as the cap of a fountain pen, many puzzling effects may be obtained.—Contributed by John Shahan, Auburn, Ala.

How to Make an Inexpensive Wooden Fan

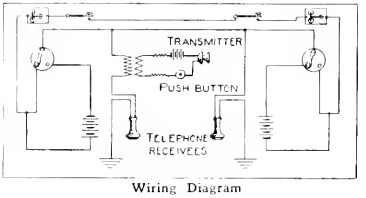
Select a nice straight-grained piece of white pine about $\frac{1}{4}$ in. thick, $\frac{3}{4}$ in. wide and 4 in. long. Lay out the design desired and cut as shown in Fig. 1, and then soak the wood in hot water to make it soft and easy to split. Cut the divisions very thin with a sharp knife down to the point A, as shown in the sketch, taking care not to split the wood through the part left for the handle. The fan is then finished by placing each piece over the other as in Fig. 2. This will make a very pretty ornament.—Contributed by Fred W. Whitehouse, Upper Troy, N. Y.



Cutting the Wood and Complete Fan

Combination Telegraph and Telephone Line

The accompanying diagrams show connections for a short line system



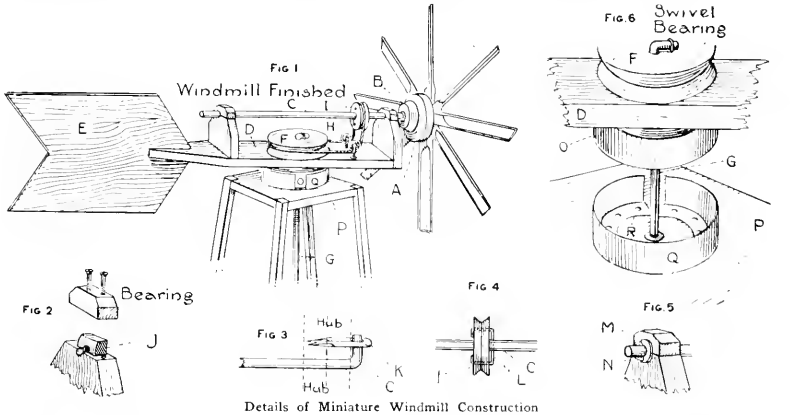
Wiring Diagram

(metallic circuit) of telegraph where a telephone may be used in combination on the line. The telephone receivers can be used both as receivers and transmitters, or ordinary telephone transmitters, induction coils and battery may be used in the circuit with a receiver. If a transmitter is used, its batteries may be connected in circuit with a common push button which is held down when using the telephone. On a 1000-ft. line, four dry cells will be sufficient for the telegraph instruments and two cells for the telephone.—Contributed by D. W. Miller.

How to Make a Miniature Windmill

The following description is how a miniature windmill was made, which gave considerable power for its size, even in a light breeze. Its smaller parts, such as blades and pulleys, were constructed of 1-in. sugar pine on account of its softness.

The eight blades were made from pieces 1 by 1½ by 12 in. Two opposite edges were cut away until the blade was about ⅛ in. thick. Two inches tended to the ground. The 2½-in. pulley, I, Fig. 1, was keyed to shaft C, as shown in Fig. 1. The wire L was put through the hole in the axle and the two ends curved so as to pass through the two holes in the pulley, after which they were given a final bend to keep the pulley in place. The method by which the shaft C was kept from working forward is shown in Fig. 5. The washer M intervened between the



Details of Miniature Windmill Construction

were left uncut at the hub end. They were then nailed to the circular face plate A, Fig. 1, which was 6 in. in diameter and 1 in. thick. The center of the hub was lengthened by the wooden disk, B, Fig. 1, which was nailed to the face plate. The shaft C, Fig. 1, was ¼-in. iron rod, 2 ft. long, and turned in the bearings detailed in Fig. 2. J was a nut from a wagon bolt and was placed in the bearing to insure easy running. The bearing blocks were 3 in. wide, 1 in. thick and 3 in. high without the upper half. Both bearings were made in this manner.

The shaft C was keyed to the hub of the wheel, by the method shown in Fig. 3. A staple, K, held the shaft from revolving in the hub. This method was also applied in keying the 5-in. pulley F, to the shaft, G, Fig. 1, which ex-

bearing block and the wire N, which was passed through the axle and then bent to prevent its falling out. Two washers were placed on shaft C, between the forward bearing and the hub of the wheel to lessen the friction.

The bed plate D, Fig. 1, was 2 ft. long, 3 in. wide and 1 in. thick and was tapered from the rear bearing to the slot in which the fan E was nailed. This fan was made of ¼-in. pine 18 by 12 in. and was cut the shape shown.

The two small iron pulleys with screw bases, H, Fig. 1, were obtained for a small sum from a hardware dealer. Their diameter was 1¼ in. The belt which transferred the power from shaft C to shaft G was top string, with a section of rubber in it to take up slack. To prevent it from slipping on the two

wooden pulleys a rubber band was placed in the grooves of each.

The point for the swivel bearing was determined by balancing the bed plate, with all parts in place, across the thin edge of a board. There a ¼-in. hole was bored in which shaft G turned. To lessen the friction here, washers were placed under pulley F. The swivel bearing was made from two lids of baking powder cans. A section was cut out of one to permit its being enlarged enough to admit the other. The smaller one, O, Fig. 6, was nailed top down, with the sharp edge to the underside of the bed plate, so that the ¼-in. hole for the shaft G was in the center. The other lid, G, was tacked, top down also, in the center of the board P, with brass headed furniture tacks, R, Fig. 6, which acted as a smooth surface for the other tin to revolve upon. Holes for shaft G were cut through both lids. Shaft G was but ¼ in. in diameter, but to keep it from rubbing against the board P, a ½-in. hole was bored for it, through the latter.

The tower was made of four 1 by 1-in. strips, 25 ft. long. They converged from points on the ground forming an 8-ft. square to the board P at the top of the tower. This board was 12 in. square and the corners were notched to admit the strips as shown, Fig. 1. Laths were nailed diagonally between the strips to strengthen the tower laterally. Each strip was screwed to a stake in the ground so that by disconnecting two of them the other two could be used as hinges and the tower could be tipped over and lowered to the ground, as, for instance, when the windmill needed oiling. Bearings for the shaft G were placed 5 ft. apart in the tower. The power was put to various uses.

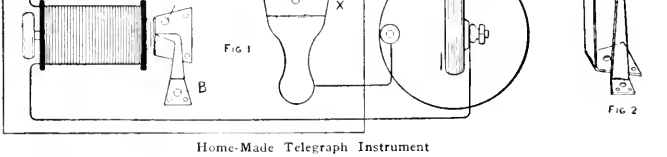
How to Make a Telegraph Instrument and Buzzer

The only expenditure necessary in constructing this telegraph instrument is the price of a dry cell, providing one has a few old materials on hand.

Procure a block of wood about 6 in. long and 3 in. wide and take the coils out of an old electric bell. If you have no bell, one may be had at the dealers for a small sum. Fasten these coils on the blocks at one end as in Fig. 1.

Cut a piece of tin 2 in. long and ½ in. wide and bend it so the end of the tin shown in the illustration. This completes the receiver or sounder.

To make the key, cut out another piece of tin (X, Fig. 1) 4 in. long and bend it as shown. Before tacking it to the board, cut off the head of a nail and drive it in the board at a point where the loose end of the tin will cover it. Then tack the key to the board and connect the wires of the battery as in Fig. 1. Now, move the coils back and forth until the click sounds just the way



Home-Made Telegraph Instrument

when fastened to the block will come just above the core of the coil. Cut another piece of tin 3 in. long and bend it as shown at A, Fig. 2. Tack these two pieces of tin in front of the coils as you wish and you are ready to begin on the Morse code.

When tired of this instrument, connect the wire from the coils to the key to point A and the one connected at

the point under the key to B, leaving the other wire as it is. By adjusting the coils the receiver will begin to vibrate rapidly, causing a buzzing sound.—Contributed by John R. McConnell.

How To Make a Water Bicycle

Water bicycles afford fine sport, and, like many another device boys make, can be made of material often cast off by their people as rubbish. The principal material necessary for the construction of a water bicycle is oil barrels. Flour barrels will not do—they are not strong enough, nor can they be made perfectly airtight. The grocer can furnish you with oil barrels at a very small cost, probably let you have them for making a few deliveries for him. Three barrels are required for the water bicycle, although it can be made with but two. Figure 1 shows the method of arranging the barrels; after the manner of bicycle wheels.

Procure an old bicycle frame and make for it a board platform about 3 ft. wide at the rear end and tapering to about 2 ft. at the front, using cleats to hold the board frame, as shown at

FIG 1.

Water Bicycle Complete

the shaded portion K. The construction of the barrel part is shown in Fig. 2. Bore holes in the center of the heads of the two rear barrels and also in the heads of the first barrel and put a shaft of wood through the rear barrels and one through the front barrel, adjusting the side pieces to the shafts, as indicated.

Next place the platform of the bicycle frame and connections thereon. Going back to Fig. 1 we see that the driving chain passes from the sprocket driver L of the bicycle frame to the place downward between the slits in the platform to the driven sprocket on the shaft between the two barrels. Thus a center drive is made. The rear barrels are fitted with paddles as at M, consisting of four pieces of board nailed

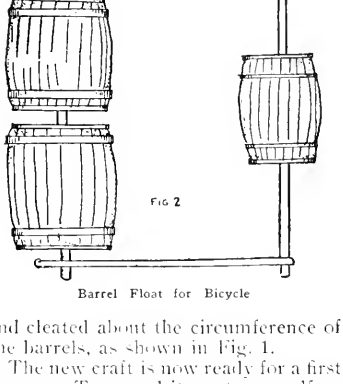


FIG 2

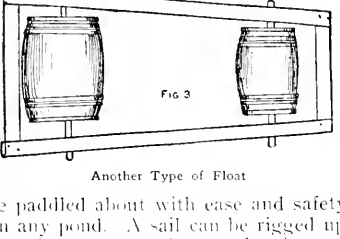
Barrel Float for Bicycle

and cleated about the circumference of the barrels, as shown in Fig. 1.

The new craft is now ready for a first voyage. To propel it, seat yourself on the bicycle seat, feet on the pedals, just as you would were you on a bicycle out in the street. The steering is effected by simply bending the body to the right or left, which causes the craft to dip to the inclined side and the affair turns in the dipped direction. The speed is slow at first, but increases as the force is generated and as one becomes familiar with the working of the affair. There is no danger, as the airtight barrels cannot possibly sink.

Another mode of putting together the set of barrels, using one large one in the rear and a small one in the front is presented in Fig. 3. These two barrels are empty oil barrels like the others. The head holes are bored and the proper wooden shafts are inserted and the entrance to the bores closed tight by calking with hemp and putty or clay. The ends of the shafts turn in the wooden frame where the required bores are made to receive the same. If the journals thus made are well oiled, there will not be much fric-

on. Such a frame can be fitted with platform and a raft to suit one's individual fancy built upon it, which can



Another Type of Float

e paddled about with ease and safety n any pond. A sail can be rigged up y using a mast and some sheeting; or ven a little houseboat, which will give ny amount of pleasure, can be built.

How To Make a Small Searchlight

The materials required for a small earchlight are a 4-volt lamp of the oop variety, thin sheet brass for the ylinder, copper piping and brass tubng for base. When completed the earchlight may be fitted to a small oat and will afford a great amount of pleasure for a little work, or it may be put to other uses if desired.

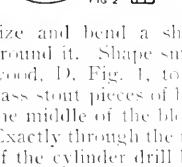


FIG 2

Make a cylinder of wood of the required ize and bend a sheet of thin brass round it. Shape small blocks of boxood, D, Fig. 1, to fit the sides and ass stout pieces of brass wire through he middle of the blocks for trunnions. Exactly through the middle of the sides f the cylinder drill holes just so large hat when the blocks containing the runnions are cemented to the cylinder here is no chance of contact between ylinder and trunnion, and so creating false circuit.

The trunnion should project slightly nto the cylinder, and after the lamp as been placed in position by means f the small wood blocks shown in Fig. , the wires from the lamp should be oldered to the trunnions. It is best to solder the wire to the trunnions before cementing the side blocks inside the cylinder.

Turn a small circle of wood, A, Fig. 2, inside the cylinder to fit exactly and fasten to it a piece of mirror, C, Fig. 2, exactly the same size to serve as a reflector. Painting the wood with white enamel or a piece of brightly polished metal will serve the purpose. On the back of the piece of wood fasten a small brass handle, B, Fig. 2, so that it may readily be removed for cleaning.

In front of cylinder place a piece of magnifying glass for a lens. If a piece

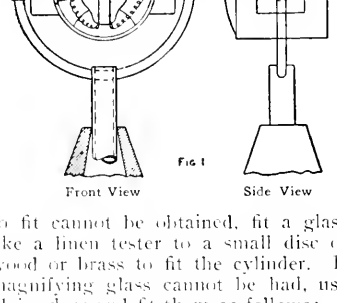


FIG 1

Front View Side View

to fit cannot be obtained, fit a glass like a linen tester to a small disc of wood or brass to fit the cylinder. If magnifying glass cannot be had, use plain glass and fit them as follows:

Make two rings of brass wire to fit tightly into the cylinder, trace a circle (inside diameter of cylinder) on a piece of cardboard; place cardboard on glass and cut out glass with a glass cutter; break off odd corners with notches on cutters and grind the edge of the glass on an ordinary red brick using plenty of water. Place one brass ring in cylinder, then the glass disc and then the other ring.

For the stand fill a piece of copper piping with melted rosin or lead. When hard bend the pipe around a piece of wood which has been sawed to the shape of bend desired. Then melt out the rosin or lead. Make an incision with a half-round file in the under side of the tube for the wires to come through. Make the base of wood as shown in Fig. 1. One-half inch from

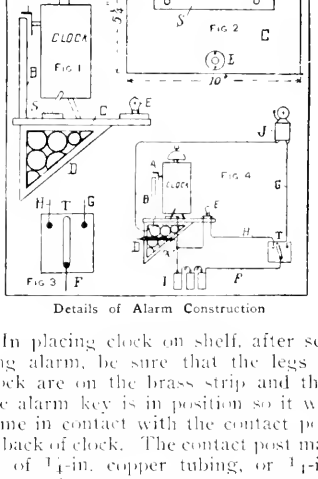
the top bore a hole large enough to admit the copper pipe and a larger hole up the center to meet it for the wires to come down.

If it is desired to make the light very complete, make the base of two pieces of brass tube—one being a sliding fit in the other and with projecting pieces to prevent the cylinder from going too far. The light may then be elevated or lowered as wished. On two ordinary brass terminals twist or solder some flexible wire, but before doing so fix a little bone washer on the screws of the terminal so as to insulate it from the tube. When the wires have been secured to the terminals cover the joint with a piece of very thin india rubber tubing, such as is used for cycle valves. The two wires may now be threaded down the copper tube into the base, and pulled tight, the terminals firmly fixed into the tubes; if too small, some glue will secure them. To get the cylinder into its carriage, put one trunnion into the terminal as far as it will go and this will allow room for the other trunnion to go in its terminal.

Electric Alarm that Rings a Bell and Turns on a Light

The illustration shows an alarm clock connected up to ring an electric bell, and at the same time turn on an electric light to show the time. The parts indicated are as follows: A, key of alarm clock; B, contact post, 1 in. long; C, shelf, $5\frac{1}{4}$ by 10 in.; D, bracket; E, electric bulb (3½ volts); S, brass strip, $1\frac{1}{4}$ in. long, $\frac{3}{8}$ in. wide and 1/16 in. thick; T, switch; F, wire from batteries to switch; G, wire from bell to switch; H, wire from light to switch; I, dry batteries; J, bell; X, point where a splice is made from the light to wire leading to batteries from brass strip under clock. Push the switch lever to the right before retiring.

To operate this, set alarm key as shown in diagram, after two turns have been made on the key. When alarm goes off, it turns till it forms a connection by striking the contact post and starts the electric bell ringing. Throw lever off from the right to center, which stops bell ringing. To throw on light throw levers to the left. The bell is then cut out but the light remains on till lever is again thrown in the center.



Details of Alarm Construction

In placing clock on shelf, after setting alarm, be sure that the legs of clock are on the brass strip and that the alarm key is in position so it will come in contact with the contact post in back of clock. The contact post may be of $\frac{1}{4}$-in. copper tubing, or $\frac{1}{4}$-in. brass rod.

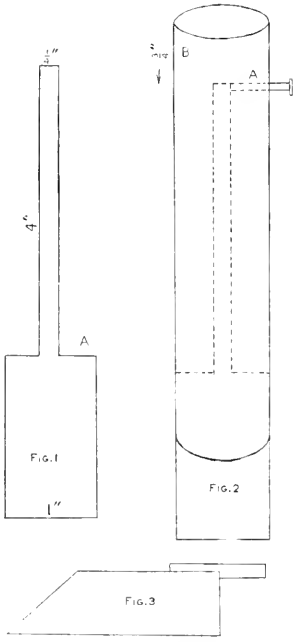
The advantage of this is that one can control the bell and light, while lying in bed, by having the switch on the baseboard, near the bed, so it can be reached without getting out of bed.—Contributed by Geo. C. Brinkerhoff, Swissvale, Pa.

How to Hold a Screw on a Screwdriver

A screw that is taken from a place almost inaccessible with the fingers requires considerable patience to return it with an ordinary screwdriver unless some holding-on device is used. I have found that by putting a piece of cardboard or thick paper with the blade of the screwdriver in the screw head slot, the screw may be held and turned into places that it would be impossible with the screwdriver alone.—Contributed by C. Chatland, Ogden, Utah.

How to Make a Lead Cannon

Any boy who has a little mechanical ability can make a very reliable cannon for his Fourth of July celebration by following the instructions given here:



Lead Cannon Construction

Take a stick (a piece of curtain roller will do) 3 in. long. Make a shoulder as at A, Fig. 1, 1 in. from one end, making it as true and smooth as possible, as this is to be the muzzle of the cannon. Make the spindle as in Fig. 1, $\frac{1}{4}$ in. in diameter. Procure a good quality of stiff paper about 6 in. wide and wrap it around the shoulder of the stick, letting it extend $\frac{3}{4}$ in. beyond the end of the spindle, as at B, Fig. 2. Push an ordinary shingle nail through the paper and into the extreme end of the spindle as at A, Fig. 2. This is to form the fuse hole.

Having finished this, place stick and all in a pail of sand, being careful not to get the sand in it and letting the opening at the top extend a little above the surface of the sand. Then fill the paper cylinder with melted lead and let cool. Pull out the nail and stick, scrape off the paper and the cannon is ready for mounting as in Fig. 3.—Contributed by Chas. S. Chapman, Lanesboro, Minn.

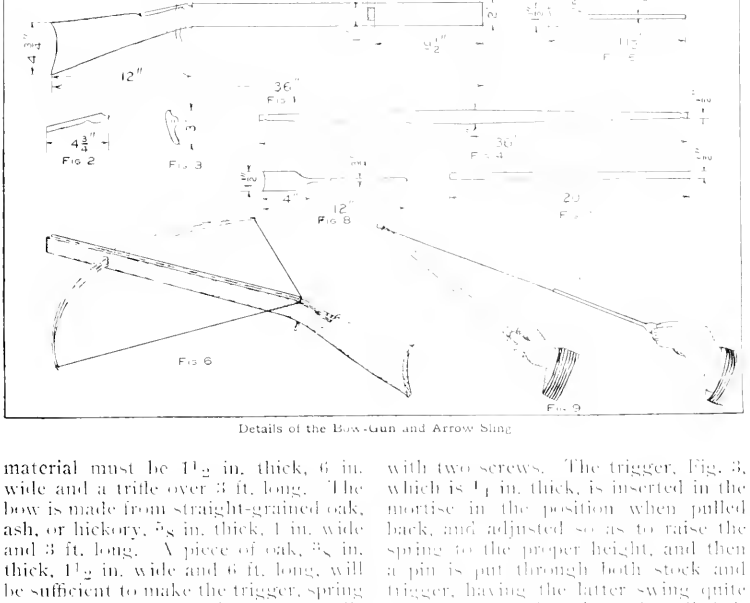
How to Waterproof Canvas

The method used by the British navy yards for waterproofing and painting canvas so it will not become stiff and cracked is as follows: One ounce of yellow soap and $\frac{1}{2}$ pt. of hot water are mixed with every 7 lb. of paint you wish to use. The mixture is applied to the canvas with a brush. This is allowed to dry for two days and then a coat of the same paint without the soap is laid on. When this last coat is dry the canvas may be painted any color desired. After three days of drying the canvas may be folded up without sticking together, and, of course, it is waterproof. The canvas waterproofed in this manner makes an excellent covering for portable canoes and canvas boats. The color mixture for the soap and second application is made from 1 lb. of lampblack and 6 lb. of yellow ochre, both in oil; the finish coat may be any color you wish. When no paint is to be used on the canvas it may be waterproofed with a mixture made from soft soap dissolved in hot water, and a solution of iron sulphate added. Iron sulphate, or ferrous sulphate, is the green vitriol. The vitriol combines with the potash of the soap, and the iron oxide is precipitated with the fatty acid as insoluble iron soap. This precipitate is then washed, dried and mixed with linseed oil and applied to the canvas. This will render the cloth waterproof at the same time the material is quite flexible and not inclined to crack.

Belt laces should never cross on the side next to the pulley as they will cut themselves in two.

How to Make a Crossbow and Arrow Sling

In the making of this crossbow it is best to use maple for the stock, but if this wood cannot be procured, good straight-grained pine will do. The opposite end, which should be slanting a little as shown by the dotted lines. A spring, Fig. 2, is made from a good piece of oak and fastened to the stock



Details of the Bow-Gun and Arrow Sling

material must be $1\frac{1}{2}$ in. thick, 6 in. wide and a trifle over 3 ft. long. The bow is made from straight-grained oak, ash, or hickory, $\frac{5}{8}$ in. thick, 4 in. wide and 3 ft. long. A piece of oak, $\frac{3}{8}$ in. thick, $1\frac{1}{2}$ in. wide and 6 ft. long, will be sufficient to make the trigger, spring and arrows. A piece of tin, some nails and a good cord will complete the materials necessary to make the crossbow.

The piece of maple or pine selected for the stock must be planed and sandpapered on both sides, and then marked and cut as shown in Fig. 1. A groove is cut for the arrows in the top straight edge $\frac{3}{8}$ in. wide and $\frac{3}{8}$ in. deep. The tin is bent and fastened on the wood at the back end of the groove where the cord slips out of the notch; this is to keep the edges from splitting.

A mortise is cut for the bow at a point $9\frac{1}{2}$ in. from the end of the stock, and one for the trigger 12 in. from the with two screws. The trigger, Fig. 3, which is $\frac{1}{4}$ in. thick, is inserted in the mortise in the position when pulled back, and adjusted so as to raise the spring to the proper height, and then a pin is put through both stock and trigger, having the latter swing quite freely. When the trigger is pulled, it lifts the spring up, which in turn lifts the cord off the tin notch.

The stick for the bow, Fig. 4, is dressed down from a point $\frac{3}{4}$ in. on each side of the center line to $\frac{1}{2}$ in. wide at each end. Notches are cut in the ends for the cord. The bow is not fastened in the stock, it is wrapped with a piece of canvas $1\frac{1}{2}$ in. wide on the center line to make a tight fit in the mortise. A stout cord is now tied in the notches cut in the ends of the bow making the cord taut when the wood is straight.

The design of the arrows is shown in Fig. 5 and they are made with the

blades much thinner than the round part.

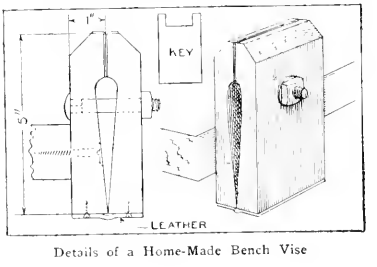
To shoot the crossbow, pull the cord back and down in the notch as shown in Fig. 6, place the arrow in the groove, sight and pull the trigger as in shooting an ordinary gun.

The arrow sling is made from a branch of ash about 1½ in. in diameter, the bark removed and a notch cut in one end, as shown in Fig. 7. A stout cord about 2½ ft. long is tied in the notch and a large knot made in the other or loose end. The arrows are practically the same as those used on the crossbow, with the exception of a small notch which is cut in them as shown in Fig. 8.

To throw the arrow, insert the cord near the knot in the notch of the arrow, then grasping the stick with the right hand and holding the wing of the arrow with the left, as shown in Fig. 9, throw the arrow with a quick slinging motion. The arrow may be thrown several hundred feet after a little practice.—Contributed by O. E. Trownes, Wilmette, Ill.

A Home-Made Vise

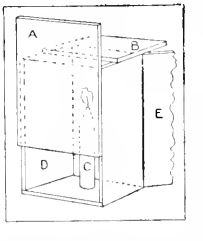
Cut two pieces of wood in the shape shown in the sketch and bore a ⅜-in. hole through both of them for a common carriage bolt. Fasten one of the pieces to the edge of the bench with a large wood screw and attach the other piece to the first one with a piece of leather nailed across the bottom of both pieces. The nut on the carriage bolt may be tightened with a wrench, or, better still, a key filed out of a piece of soft steel to fit the nut. The edges of the jaws are faced with sheet metal which can be copper or steel suitable for the work it is intended to hold.



Details of a Home-Made Bench Vise

Temporary Dark Room Lantern

Occasionally through some accident to the regular ruby lamp, or through the necessity of developing while out of reach of a properly equipped dark room, some makeshift of illumination must be improvised. Such a temporary safe light may be made from an empty cigar box in a short time.



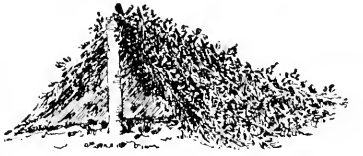
Remove the bottom of the box, and nail it in position as shown at A. Remove one end, and replace as shown at B. Drive a short wire nail through the center of the opposite end to serve as a seat for the candle, C. The lamp is finished by tacking two or more layers of yellow post-office paper over the aperture D, bringing the paper well around to the sides and bottom of the box to prevent light leakage from the cracks around the edges, says Photo Era. The hinged cover E, is used as a door, making lighting and trimming convenient. The door may be fastened with a nail or piece of wire. It is well to reinforce the hinge by gluing on a strip of cloth if the lamp is to be in use more than once or twice. This lamp is safe, for the projecting edges of A and B form light-shields for the ventilation orifice and the crack at the top of the hinged cover, respectively. Moreover, since the flame of the candle is above A, only reflected and transmitted light reaches the plate, while the danger of igniting the paper is reduced to a minimum.

The paint will sag and run if too much oil is put in white lead.

Camps and How to Build Them

For a short camping excursion, or for use while the permanent camp is being built, nothing is more novel and delightful than the temporary camp built of the materials ever ready in the woods.

The simplest form of all perhaps is the Indian camp. To build this, cut an evergreen tree nearly through about 5 ft. above the base of the trunk, so that when the top falls the butt will still be attached to the stump. Hollow out the under side of the treetop by removing boughs and branches. Use the trunk of the fallen part as a ridge pole and bank boughs and branches from it to the ground on either side. The shelter thus formed will be very comfortable, but there are other kinds



The Indian Camp

better calculated to protect from heavy rainstorms. A wigwam sheds rain well because its sides are so steep. Set up three long poles in the form of a pyramid and tie their tops together. Fill the open spaces with poles set at the same slant about 1 ft. apart at the ground and fastened at the top as before. Thatch the outside closely with branches and brush.

There are several ways to build a brush camp, but they all have many similar points. The ridge pole for such a camp (about 8 ft. long) may be placed between two trees at a height of about 6 ft., or between two crotched poles set firmly in the ground for the purpose. Long branches may be used to form the sides, but the best method is to lay straight poles on a slant from the ridge-pole to the ground, about 8 in. apart. Begin at the bottom and thatch the sides to the top to a depth of about 1 ft. with hemlock or cedar boughs, laying them with the feather side down; by means of poles weight down the thatch. Such a shelter carefully made will withstand heavy rains.

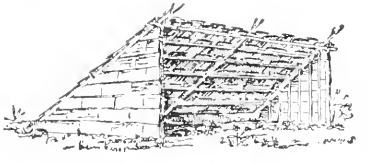
The Brush Camp

Another camp in high favor among campers for temporary shelter is the lean-to; this may be an open lean-to—that is, without ends—or closed as desired and may be thatched with either bark or brush. Select two crotched poles about 7 ft. long and set in the ground. Lay another pole across these, with its ends resting in the crotches of the other poles. From this pole slant three other poles to the ground. Push the ends of them well into the earth and fasten securely by means of crotched sticks placed over them and driven into the ground. Across these last three poles lay cross-sticks, on

The Wigwam

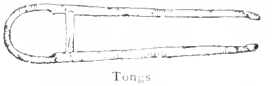
which pile brush and weight it down with other poles. Build up the sides in the same way. Where bark is used to thatch the lean-to the top side of the rafters should be flattened so the bark can be nailed to them. Bark may also

be used to thatch the wigwam, laying it in overlapping courses, beginning at the bottom, and securing it by means of cord.



A Closed Lean-to, Thatched with Bark

To remove bark from trees, cut two circles 6 ft. apart completely around the tree and join the cuts thus made by a vertical cut and pry away the bark by means of an axe. It is most readily removed in the early summer. Lay the bark on the ground to dry for a few days, weighting it down with stones, after which it is ready for use



Tongs

Hemlock, spruce or cedar boughs, having all large boughs removed so that only fine branches are left, piled to a depth of 2 ft. and with the blankets or sleeping bag on these, make the best bed for the temporary shelter. Another form of bed can be made by sewing deep hems in each side of a piece of heavy duck canvas about 40 in. wide and 6 ft. long. Set four forked poles in the ground, run poles 3 ft. long and 2 in. in diameter through the hems of the canvas and set up on the forked poles so it is about a foot above the ground.

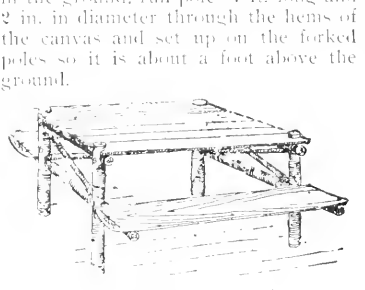


Table and Chairs Combined

In selecting a site for a camp always remember that above everything else fresh water within easy reach is essential. Shade for the hottest part of the day should be considered also. Other considerations vary with the party, the duration of the outing, the country surrounding, etc.

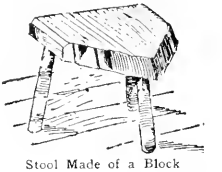
To make a crane set two green sticks 2 in. thick and 3 ft. long into the ground a foot from either end of the fire. Split the top ends with an axe and provide another stick as a support. A pair of tongs may be made from a piece of tough green wood, which should be 1½ in. in diameter, 3 ft. long and of some wood, such as elm, or hickory, which will bend easily. Cut it half way,

Broom of Hemlock Twigs

a distance of 1 ft. in the center, heat the center over a bed of coals until it will bend together without breaking, whittle into shape and fasten the two arms in position by means of a cross-piece. Shape the ends so they will catch hold of anything that has dropped into the fire. A round stick several feet long will serve as a poker.

To make a broom bind hemlock twigs around one end of a stick, using wire or stout cord to hold them in place. Stools are easily made by sawing a 3-in. block from a log 1 ft. thick. Bore three holes in one side of the block, into which drive pegs. A back may be added if desired.

For a rude table set four posts in the ground, nail cross-pieces on top, and cover with slabs cut from soft wood logs. At the right height for seats nail pieces on the legs to extend out on each side and receive slabs which will serve as seats.



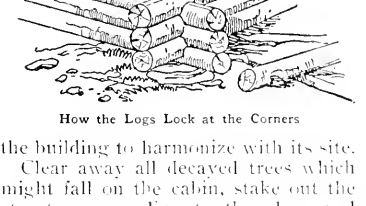
Stool Made of a Block

Many other articles of use about the temporary camp can be made from such materials as the timber affords. Such things as nails, cord, an axe, etc.,

are indispensable to the camping outfit.

No place could be more picturesque and cozy than the log cabin camp, especially where care in choosing its site has been exercised.

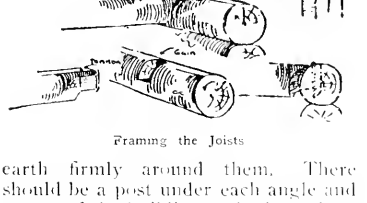
Aside from the boating, hunting and fishing advantages of the camp's location, the scenery surrounding it should be considered; it should not be near a swamp, but on high dry ground and, if possible, near a running stream, but always near pure, fresh water. Plan



How the Logs Lock at the Corners

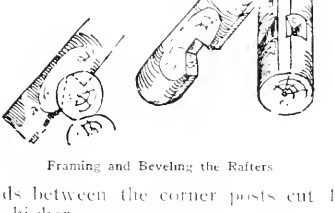
the building to harmonize with its site.

Clear away all decayed trees which might fall on the cabin, stake out the structure according to the plans and clear off the place it is to occupy. For foundation posts use cedar if possible, but tamarack, pine or hemlock will do. Select sound timber about 12 in. in diameter and 5 ft. long. Dig post holes down to solid ground or rock, or about 3 ft. deep; set the posts, tamping the



Framing the Joists

earth firmly around them. There should be a post under each angle and corner of the building and where these are quite a distance apart, as many in between as necessary. In a distance of 20 ft. there should be four posts, including those at the corners, and in 12 ft., three posts. After the posts are set, mark the one in highest ground 10 in. above the ground and cut off squarely. Cut all the others, save those at the ends between the corner posts, on a level with the first one. Those at the



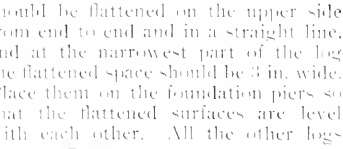
Framing and Beveling the Rafters

ends between the corner posts cut 1 in. higher.

Stone foundation piers, instead of posts, may be made by digging pits 3 ft. deep and 2 ft. in diameter, filling them up with small stones to ground level and laying large cobble-stones on top of these, chinking up with small stones any places that may remain open.

For building the cabin use straight, sound timber from 6 to 10 in. in diameter. Tamarack, balsam, pine, spruce and hemlock are all good for the purpose. Each log should be cut 2 ft. longer than the side of the building in which it is to be used. Where the tops of the trees are straight and sound they may be used for rafters, joists, etc. If the timber is brought some distance to the building site, it should be placed on skids and thus hauled to camp.

For the first tier of logs select the strongest, best shaped and largest of all. These sills, as they are called, should be flattened on the upper side from end to end and in a straight line, and at the narrowest part of the log the flattened space should be 3 in. wide. Place them on the foundation piers so that the flattened surfaces are level with each other. All the other logs



How the Roof Should Look

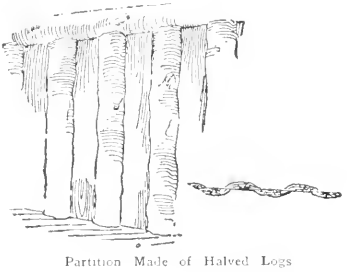
for the walls flatten on both sides. When the sills are laid cut notches in the logs and lay the floor sleepers.

To join the logs at the corners, on the under side a foot from each end cut a hollow which will fit over the round side of the log beneath. Place

Crosspieces Where Joists Are Cut for Openings

the logs so the large and small ends of them come alternately. Lay the logs carefully, being sure that each log is properly laid before proceeding with another. Continue laying the tiers until the height of the tops of the windows and doors is reached. At this point saw out the top log the proper width of each window and door to be made, lay the next tier of logs and then resume sawing out the openings for windows and doors.

Have ready door and window frames made of boards 1 in. thick and planed on one side. Nail them in the openings to hold the loose ends of the logs.

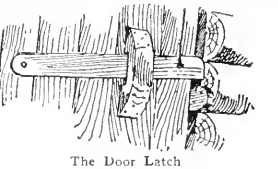


Partition Made of Halved Logs

Make the window sills slanting so they will shed water.

If there are to be two floors to the cabin, at the height of the second floor lay peeled joists, which should be of straight sound timber 6 in. in diameter if the span is 12 ft.; thicker if the span is longer. Always place them so they will have the shortest span possible and about 3 ft. apart. Flatten their upper sides from end to end, using a chalk line and a broad axe for the purpose. To place the joists cut gains, as shown in cut, in the logs that receive the joists and make tenons on the ends of the logs. Use spikes to fasten them. Where partitions are to run the same way of the joist, place a strong joist under each one. At openings for stairs cut the joists at the proper places and put a crosspiece between two joists across the cuts, joining by means of gains and tenons as before.

In putting up the rafters raise the gable rafters first. The best roof is a steep one. Select and flatten the rafters just as you did the joists. Frame their lower ends to fit the plate-logs

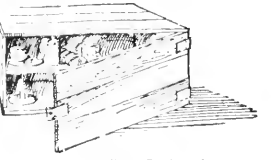


The Door Latch

and bevel their tops according to the slant of the roof. Use a ridge-pole to fasten the rafters to at the top. Lay them about 3 ft. apart and spike them to the ridge-pole at the top. Select small timber about 4 in. in diameter, flatten one side and halve them on to the rafters, letting them extend over the gable ends about 6 in. Nail them in place.

If shingles cannot be procured for a covering, bark will do very well. The bark should be removed from large trees and laid on in long strips, overlapping 6 in.

For floors use matched and planed pine boards 1 in. thick and 6 in. wide. For the second story floor they should be planed on both sides, unless two



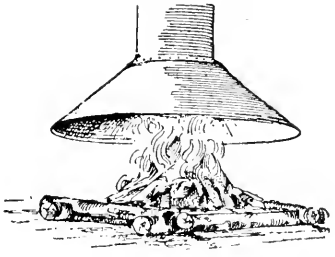
Packing Box Cupboard

thicknesses are used, in which case the boards should be put on with the rough surfaces facing.

To make partitions saw logs in longitudinal halves, and nail them in form

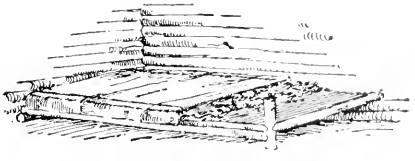
with their flat sides facing and overlapping just enough to hold firmly when nailed together. This will make each side of the partition consist of a round log surface and a flat one alternately. Place a log on top of the partition and spike into place.

Window sash must be procured from some outside source of supply and they should be placed in the frames so they will be waterproof. Windows that swing out are most convenient. Straps of old leather will do for hinges and a hardwood bar on the sash, having holes bored in it to fit over iron pins in the frame will be convenient for holding it open, while a leather strap to button over the nail will hold it closed. Make doors of matched boards and use braces and crosspieces on them, nailing them securely. If hinges are not



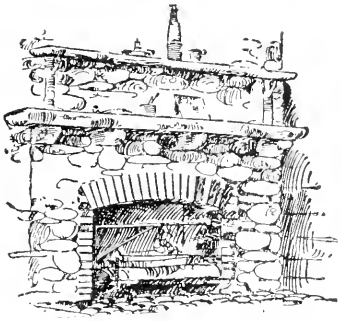
A Funnel Fireplace

to be had, bore a large deep hole at one side of the door in the upper part of the frame, and another directly opposite in the lower part of the frame. In these holes slip the ends of a strong round stick which will turn in them



Bunk with Mattress of Springy Boughs

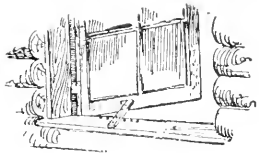
easily. Nail the door on one side of the pole. To fasten the door make a wooden catch and provide a strong bar to work as a latch. Fasten a string to the latch on the inside and pass it through a hole in the door to the outside. Screens add much to the comfort



The Fireplace with Rustic Mantel

of a cabin and may be provided if desired.

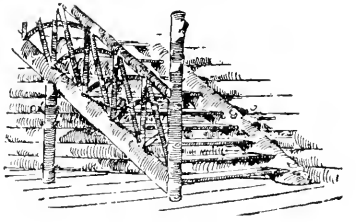
The fireplace should be built up with the cabin, laying stone foundations for it at the time the other foundations are laid, using cement mortar. The fireplace should be of firebrick, but may have a stone face. The opening should not be larger than 3 ft. high and 5 ft. wide and be arched at the top. The fireplace should have a deep throat and the smoke flue should be about 16 in. square. Build the chimney of brick, and to prevent the roof from leaking around it lay pieces of tin in the brick work, letting one edge extend under the shingles at the top side of the chimney and over them at the lower and at the sides let the tin turn down against other pieces laid with the



To Hold the Window Open

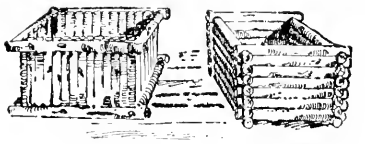
shingles. If the chimney reaches above the ridge-pole it will have a good draft without capping it over, but if below the ridge-pole it should be capped. The

fireplace may be built up in a ledge to support a mantel, or wooden brackets may be made. A crane may be made



Rustic Stairway

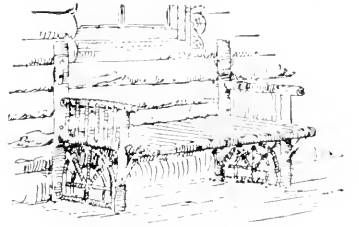
by bracing an iron bar to an upright piece. Sockets for the crane should be built in with the brick and the vertical piece should have pins to fit into them.



Two Styles of Wood Box

The arm should be provided with hooks, on which to hang vessels, etc.

Another kind of fireplace consists of a huge inverted sheet-iron funnel 3 ft. wide at its lower part and tapering up to fit the smoke pipe about 12 in. in diameter. The top of the pipe extends above the roof; the funnel is suspended over a foundation of stone, brick or clay 8 in. deep and which supports the firebed which is held together by a

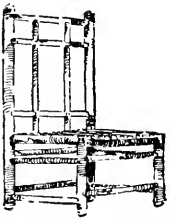


An Inviting Window Seat

frame of green logs. This is a good arrangement for warmth.

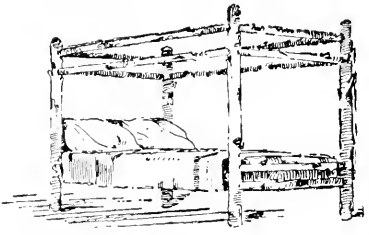
In building a stairway the frame is built of poles, and as to the work put on it, one may suit his fancy. Halved logs may be used for steps and are convenient for many other purposes.

Bunks may be made by placing small straight even poles on a frame work of poles at least 1 ft. above the floor and laying even-sized boughs and fine twigs to the depth of 2 ft., laying pieces at sides, head and foot to hold the boughs in place and on these laying the blankets or sleeping bag. A packing box can be used for a cupboard by hinging its cover and furnishing with a few shelves.



Made of Green Saplings

For furnishings for the cabin there is a wide range for suiting individual tastes. Many articles, such as chairs, beds, wood boxes, tables, etc., may be built of poles and nails. Window seats add to the appearance of comfort and



Canopied Couch Built of Small Poles

rustic seats can be built for the veranda.

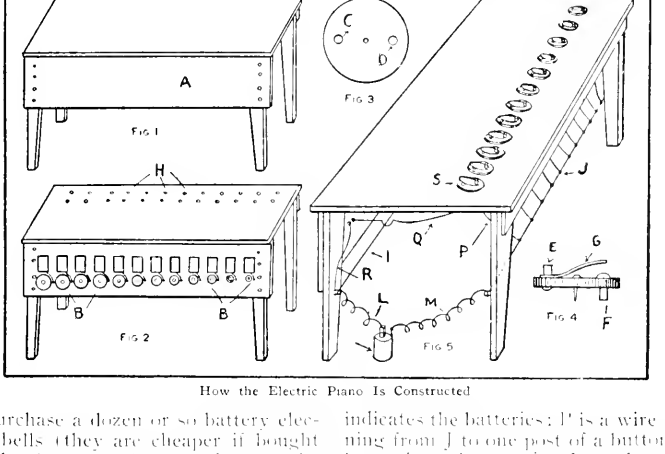
For the disposal of garbage it is well to dig a hole a little distance from the camp, sprinkling a little of the excavated material over any refuse that is placed in it.

The cabin may be finished more inside if thought best, but this detracts rather than adds to its appropriateness. Calking should be done as late as possible, so the logs can dry out a little. For calking use oakum or moss, pressing it in between the logs from both sides,

using a wooden chisel and a mallet to force it in. Care in the details of the camp will afford a place as inviting and comfortable as can be desired.

To Make an Electric Piano

Make or buy a table about 3 ft. long and 1 ft. or more wide, and about $2\frac{1}{2}$ ft. high. Nail a board (A, Fig. 1) about 8 in. wide and of the same length as the table, to the table as shown in the illustration. Paint the table any color desired.



How the Electric Piano Is Constructed

Purchase a dozen or so battery electric bells (they are cheaper if bought by the dozen) and screw them to the board. (See Fig. 2.) Arrange the bells in the scale as shown at B, Fig. 2. Bore two holes, near the posts of each bell for the wires to pass through.

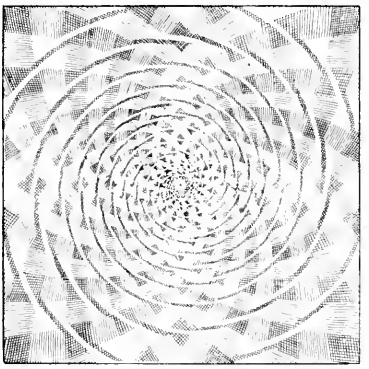
Buttons for the bells may be purchased, but it is cheaper to make them in the following way: Take a piece of wood and cut it round, about $2\frac{1}{2}$ in. in diameter and $\frac{1}{4}$ in. thick (Fig. 3) and bore two holes (C and D) through it. Then get two posts, about 1 in. long (battery posts will do) and put them through the holes as at Fig. 4. Cut out a piece of tin, $\frac{3}{8}$ in. wide, punch a hole through it and put in under post E, Fig. 4, so that when it is pressed down, it will touch post F, Fig. 4. It may be either nailed or screwed down (G, Fig. 4).

Make two holes in the table for each button and its wires (H, Fig. 2). Nail or screw the buttons to the table as shown at Fig. 5 with the wires underneath. The connections are simple: I in Fig. 5 is a wire running from one end of the table to the other end, attached to a post at each end; J, is another wire attached in the same way; L is the carbon wire running from the batteries to I; M is the zinc wire running from the batteries to wire J; O indicates the batteries; P is a wire running from J to one post of a button; Q is another wire running from the other post of the button to one of the posts of the bell; R is a wire running from I to one post of the bell. When the button S is pressed, the bell will ring. Each button should be connected with its bell in the same way. One battery can be used with each bell if preferred.—Contributed by Vincent de Ybarrondo, Los Angeles, Cal.

Felt from an old hat makes good packing for automobile water circulating pumps. Strips should be cut to fit snugly in the stuffing box. When the follower is screwed down, it will expand the felt and make a watertight joint.

Another Optical Illusion

After taking a look at the accompanying illustration you will be positive that the cords shown run in a spiral toward the center, yet it shows a series of per-



The Cord Is Not a Spiral

fect circles of cords placed one inside the other. You can test this for yourself in a moment with a pair of compasses, or, still more simply, by laying a point of a pencil on any part of the cord and following it round. Instead of approaching or receding from the center in a continuous line, as in the case of a spiral, you will find the pencil returning to the point from which it started.

Substitute for Insulating Cleats

In wiring up door bells, alarms and telephones, as well as experimental work the use of common felt gun wads make a very good cleat for the wires. They are used in the manner illustrated in the accompanying sketch. The insulated wire is placed between two wads and fastened with two nails or screws. If one wad on the back is not thick enough to keep the wire away from the support, put on two wads behind and one in front of the wire and fasten in the same manner as described.

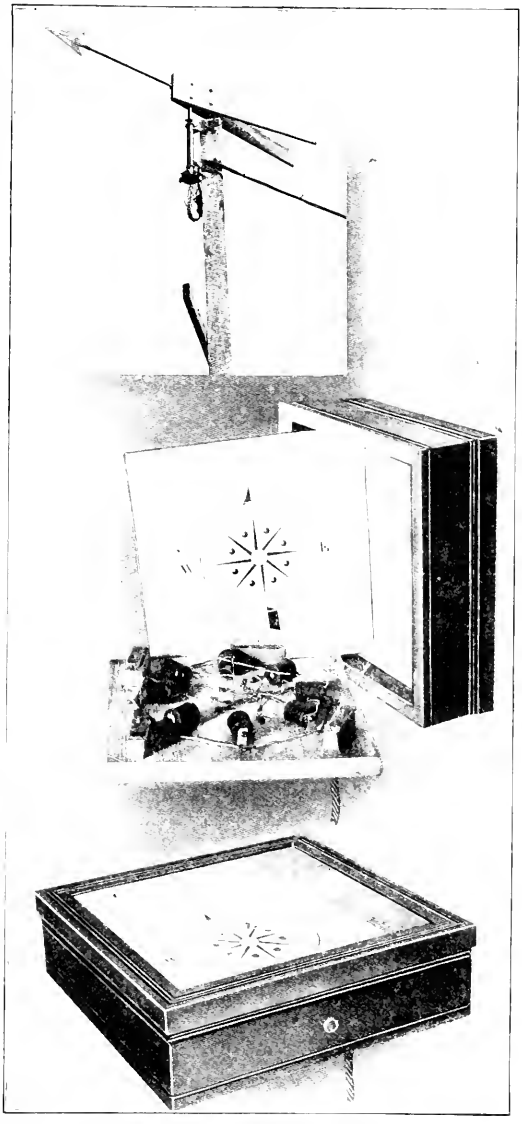
Electrically Operated Indicator for a Wind Vane

The accompanying photograph shows a wind vane connected with electric wires to an instrument at considerable distance which indicates by means of a magnetic needle the direction of the wind. The bearings of the vane consist of the head of a wornout bicycle. A ¾-in. iron pipe extends from the vane and is held in place by the clamp originally used to secure the handle bar of the bicycle. In place of the forks is attached an eight-cylinder gas engine timer which is slightly altered in such a manner that the brush is at all times in contact, and when pointing between two contacts connects them both. Nine wires run from the timer, one from each of the eight contacts, and one, which serves as the ground wire, is fastened to the metallic body. The timer is set at such a position that when the vane points directly north, the brush of the timer makes a connection in the middle of a contact. When the timer is held in this position the brush will make connections with each of the contacts as the vane revolves.

The indicating device which is placed in a convenient place in the house consists of eight 4-ohm magnets fastened upon a 1-in. board. These magnets are placed in a 10-in. circle, 45 deg. apart and with their faces pointing toward the center. Covering these is a thin, wood board upon which is fastened a neatly drawn dial resembling a mariner's compass card. This is placed over the magnets in such a manner that there will be a magnet under each of the eight principal points marked on the dial. Over this dial is a magnetic needle or pointer, 6 in. long, perfectly balanced on the end of a standard and above all is placed a cover having a glass top. The eight wires from the timer contacts connect with the outside wires of the eight magnets separately and the inside wires from the magnets connect with the metal brace which holds the magnets in place. A wire is then connected from the metal

brace to a push button, two or three cells of dry battery and to the ground wire in connection with the timer. The wires are connected in such a manner that when the vane is pointing in a certain direction the battery will be connected in series with the coil under that part of the dial representing the direction in which the vane is pointing, thus magnetizing the core of the magnet which attracts the opposite pole of the needle toward the face of the magnet and indicating the way the wind is blowing. The pointer end of the needle is painted black.

If the vane points in such a direction that the timer brush connects two contacts, two magnets will be magnetized and the needle will point midway between the two lines represented on the dial, thus giving 16 different directions. Around the pointer end of the needle is wound a fine copper wire, one end of which extends down to about $\frac{1}{2}$ in. of the dial. This wire holds the needle in place when the pointer end is directly over the magnet attracting it; the magnet causing the needle to "dip" will bring the wire in contact with the paper dial. Without this attachment, the needle would swing a few seconds before coming to a standstill.



The Wind Vane, Magnets and Indicator

The vane itself is easily constructed as can be seen in the illustration. It should be about 6 ft. long to give the best results. The magnets used can be purchased from any electrical store in pairs which are called "instrument magnets." Any automobile garage can supply the timer and an old valueless bicycle frame is not hard to find. The cover is easily made from a picture frame with four small boards arranged to take the place of the picture as shown.

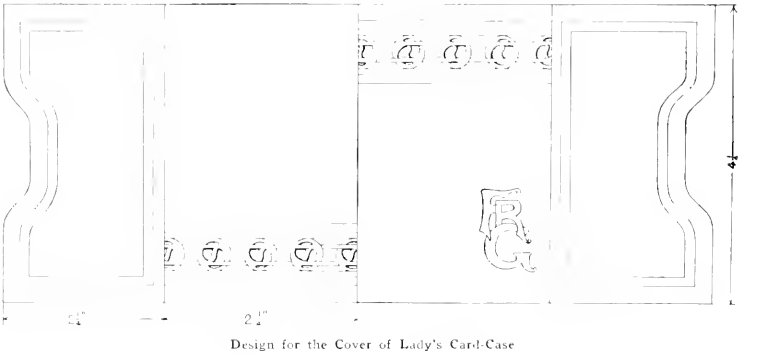
The outfit is valuable to a person who is situated where a vane could not be placed so as to be seen from a window and especially at night when it is hard to determine the direction of the wind. By simply pressing the push button on the side of the cover, the needle will instantly point to the part of the dial from which the wind is blowing.—Contributed by James L. Blackmer, Buffalo, N. Y.

A Home-Made Floor Polisher

An inexpensive floor polisher can be made as follows: Secure a wooden box with a base 8 by 12 in. and about 6 in. high, also a piece of new carpet, 14 by 18 in. Cut 3-in. squares out of the four corners of the carpet and place the box squarely on it. Turn three of the flaps of the carpet up and tack them securely to the sides of the box. Before tacking the fourth side, fold a couple of newspapers to the right size and shove them in between the carpet and the bottom of the box for a cushion. Fill the box with any handy ballast, making it heavy or light, according to who is going to use it, and securely nail on the top of the box. The handle can be made from an old broom handle the whole of which will be none too long. Drive a heavy screweye into the big end of the handle and fasten to the polisher by a staple driven through the eye into the center of the cover, thus making a universal joint. The size of the box given here is the best although any size near that, if not too high, will answer the purpose just as well. The box is pushed or pulled over the floor and the padded side will produce a fine polish.

How to Make a Lady's Card-Case

A card-case such as is shown here makes a very appropriate present for any lady. To make it, secure a piece of "ooze" calf skin leather $4\frac{1}{2}$ by $10\frac{1}{2}$ in. The one shown in the accompanying picture was made of a rich tan ooze of light weight and was lined with a grey-green goat skin. The design was stenciled and the open parts backed with a green silk plush having a rather heavy nap. The lining of goat skin need not cover more than the central part—not the flies. A piece $4\frac{1}{2}$ by 5



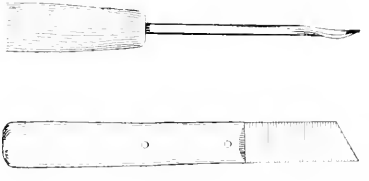
Design for the Cover of Lady's Card-Case

in. will be sufficient. A piece of plush 1¼ by 6 in. will be enough for the two sides.

Begin work by shaping the larger piece of leather as shown in the drawing. Allow a little margin at the top and bottom, however, to permit trimming the edges slightly after the parts have been sewed together. A knife or a pair of scissors will do to cut the leather with, though a special knife, called a chip carving knife, is most satisfactory.

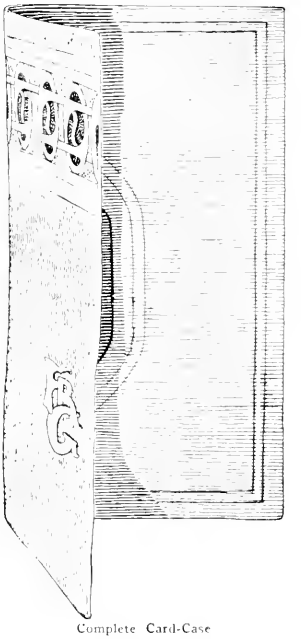
The next thing is to put in the marks for the outline of the designs and the borders. A tool having a point shaped as in the illustration is commonly used. It is called a modeling tool for leather and may be purchased, or, one can be made from an ordinary nut pick by taking off the sharpness with fine emery paper so that it will not cut the leather. To work these outlines, first moisten the leather on the back with as much water as it will take and still not show through on the face side. Place the leather on some level, non-absorbent surface and with the tool — and a straightedge on the straight lines indent the leather as shown. The easiest way is to place the paper pattern on the leather and mark on the paper. The indentations will be transferred without the necessity of putting any lines on the leather.

With the knife cut out the stencils as shown. Paste the silk plush to the inner side, being careful not to get any of the paste so far out that it will show. A good leather paste will be required.



Leather Tools

Next place the lining, fold the flies along the lines indicated in the drawing. Hold the parts together and stitch them on a sewing-machine. An ordinary sewing-machine will do if a good stout needle is used. A silk thread that will match the leather should be used. Keep the ooze side of the lining out so that it will show, rather than the smooth side. With the knife and straightedge trim off the surplus material at the top and bottom and the book is ready for use.



Complete Card-Case

Home-Made Fire Extinguisher

Dissolve 20 lb. of common salt and 10 lb. of sal ammoniac in 5 gal. of water, and put the solution in thin glass bottles, cork tightly and seal to prevent evaporation. The bottles should hold about 1 qt. If a fire breaks out, throw one of the bottles in or near the flames, or break off the neck and scatter the contents on the fire. It may be necessary to use several bottles to quench the flames.

How to Make Water Motors

To make the pattern of a water motor shown in Fig. 1, first get a disk constructed like A, about 20 in. in diameter. This disk can be cut out of sheet metal, or it may be made of pine wood, using common boards. The sheet

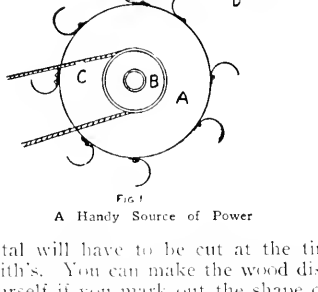


FIG 1

A Handy Source of Power

metal will have to be cut at the tinsmith's. You can make the wood disk yourself if you mark out the shape on the boards in pencil and cut the material accordingly. After the disk is ready, the hub should be designed. This consists of the wooden wheel B. This wheel can be purchased ready made at a hardware or a general tool and machinery store. The wheel is grooved, about .5 in. in diameter, and of ample width to fit the shaft and carry the rope C. The wheel is fitted to the wood shaft with a key or screw. Next comes the application of the water wings or paddles. These are made of curved sheet metal of the design shown. They

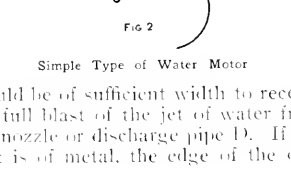


FIG 2

Simple Type of Water Motor

should be of sufficient width to receive the full blast of the jet of water from the nozzle or discharge pipe D. If the disk is of metal, the edge of the disk must be turned, so as to provide a shoulder to secure the paddles to either by soldering or by using little bolts passed through holes bored for the purpose. If there is a wooden disk used, the paddles are set-screwed to the rim direct. Thus we have the paddles in place, so that the discharge of water plays into each as it comes around the circuit as at E. Considerable speed can be developed with the common hose pipe. The power generated in this way is used for running sewing machines, fan wheels, dust wheels, etc. The entire affair fits in boxed framework of wood, so that the water will be kept in. The water is drawn off through the base of the framework to the drain pipe. These devices may be seen in use for mechanical service in connection with running automatic contrivances in show windows.

The skeleton-like arrangement in Fig. 2 is made with the hub of small size as shown, to which the large wings or paddles are secured with set-screws. This hub is metal. It can be made by hack-sawing the same from a section of metal 3 to 4 in. in diameter and boring for the hole. Sometimes a common cart wheel hub can be used for the purpose. The wings have to be of wrought or other stiff metal, so that they will retain their form under the pressure of the water. These paddles are about 3 in. wide. Common 3-16 or 1-8-in. metal will answer the purpose. The wheel is set upon its shaft and the plan is made for the volume of water to fall upon the paddles from an outlet as at F. The water force contacts with the paddle at G, as shown. The shaft which carries the wheel also carries the driving wheel, which is for a flat belt or round belt, as the case may be. It is quite easy to

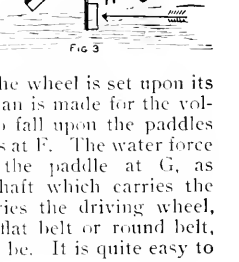


FIG 3

get from ½ to 3 hp. from these various types of home-made wheels.

The wheel in Fig. 3 is calculated for use in direct contact with the water. A running stream of water is selected and the wheel is adjusted on its shaft so as to drop the lower portion of the wheel into the moving currents as shown. The water contacts with each box-paddle, as at H, in turn, and keeps the wheel revolving according to the velocity of the water. First we make the hub or center of two pieces of hardwood bolted together and protected with flanges on either side. The two pieces can be sawed from boards and fitted together with the hole for the shaft bored through. The hub is applied to the shaft. The spokes for the paddle boxes are adjusted into holes bored around the circuit of the hub, same as spokes are fitted to the common wheel hub. Then the paddle boxes of tin or of wood are secured to the end of each spoke. These boxes are about 4 in. square with sides about 2 in. deep. Sometimes it is necessary to run the wheel within a case of sheet metal, as in Fig. 4. The case has an opening to let the water discharge in, as at I, and an opening to let the used water out, as at J. The case is usually set up on the brick masonry, as indicated. The affair is usually in the basement. The wheel is made with four plain paddles and the power is generated by the water striking the paddle, as at K. The hub is of wood, or as before, a discarded carriage or wagon wheel hub will do. The paddles are wood, about 4 in. wide and 30 in. long. They are mortised into the hub.

Figure 5 is another view of this wheel. The hub is marked M. The section of paddles shown is marked N. The shaft extends through the hub, and is secured to the hub with pins or a key. To one end of the shaft there is fixed the pulley for carrying the belt P. The journals for supporting the shaft are adjusted between the wheel center and the shaft ends. Several who have made this pattern of wheel have been able to get satisfaction from it. It is simple and is capable of generating quite a degree of power, which may be transmitted to some device through the agency of the belt P.

In Fig. 6 is shown another design, which can be constructed with materials usually easily collected. The hub is made first as in the case of the other wheels, and this may again be a common wheel hub, with the belt wheel fixed on the shaft adjoining it. Or in case a wheel hub is not at hand, the hub can be made of a hardwood block, bored and rounded to suit the conditions. Then the spokes are inserted into holes made in the hub for the purpose. These spokes are of hardwood and a good way to get them is to secure spokes of an old carriage wheel. In fact, a good way to do is to get a wheel from a blacksmith or wheelwright and use it as it is, removing the rim, cutting the spokes to right length,

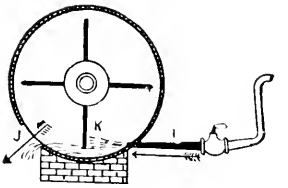


Fig. 4

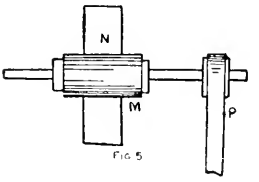


Fig. 5

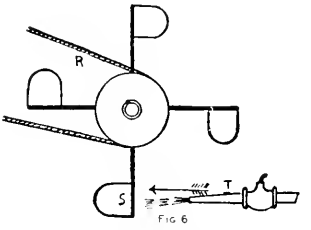
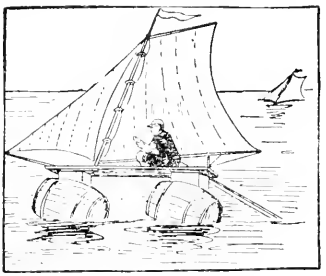


Fig. 6

and if necessary sawing off every other spoke. Or perhaps it will be necessary to saw off two of every three spokes. This gives you a very strong base to work with. The wheels can be bought for a very little money after they are cast to the junk heap. Many times they are given away. Thus if we were making the pattern of wheel in Fig. 6, all the spokes of the wheel would be sawed off except the four shown. To these spokes, at the ends, the bowl-shaped tins are fixed. They are fastened with screws or rivets so that the spoke crosses direct over the front of the opening. The water force is from the pipe T, and the discharge forcibly meets the bowl S, causing the wheel to revolve, bringing the next bowl in position, and so on. The rope belt is marked R, and is extended to the device to be driven.

A Barrel Boat for Sailing

The barrel sailing boat is very easily constructed and it is one of the best devices known to instruct a young person in the art of managing sails. The barrel boat can be put together in one day, and the only part that needs to be

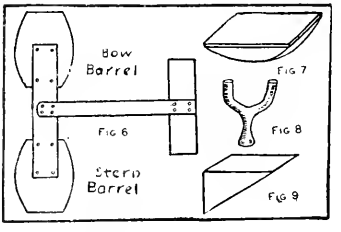


Sailing in a Barrel Boat

bought is the material for the sail. Figure 6 shows the hull of the barrel boat. It consists of a bow barrel and a stern barrel, joined together by one strong plank and a simple outrigger which extends from the plank. In order that the barrels may not present a flat front, which would be difficult to push through the water, they are, as shown in the illustration of the completed boat, fastened to the plank at an angle. The angle is made by placing between each barrel and the plank a triangular shaped brace, such as shown in Fig. 9. Both barrels must be covered with tar and painted so that they will be absolutely water-tight.

The outrigger (Fig. 7), is a small scow-shaped affair, about 2½ ft. long and 1 ft. wide. An ordinary oar or paddle is used for steering. A notched stick (Fig. 8) or an iron rowlock can be fastened over the stern barrel to hold the steering oar.

The barrel boat, when completed, will consist of two large air-tight compartments and is, therefore, unsinkable, and because of the out-rigger is very difficult to tip over. Hence it is safe to carry quite a large spread of sail. In a stiff breeze the barrel boat is more seaworthy than rapid, because the waves slap against the ends of the barrels, but in a light breeze when the



Rigging of Barrel Boat

water is smooth, the barrel boat compares favorably in point of speed with the ordinary small sail boat.

A little borax added to flour paste will double its adhesive power, and keep it from souring, also.

When using a new file, on babbitt or aluminum, rub it with a piece of chalk or soapstone. This fills the teeth of the file so chips cannot stick in them and cut scores in the work.

Mechanics for Young America

A Simple Steamboat Model

The small boat shown in the accompanying sketch may have a length of 12 to 18 in. and is constructed in the following manner: A small steam boiler, A, is supported by two braces over an alcohol lamp in the middle of the boat. A small pipe is fastened to the top of the boiler in such a way that the open end will be opposite the open end of another pipe, B, somewhat larger in size. The pipe B opens into the stern of the boat at C, as shown in Fig. 1. The steam, coming through

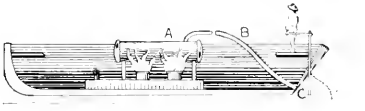


FIG. 1

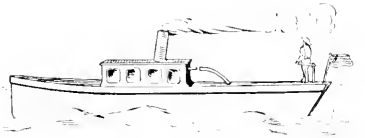


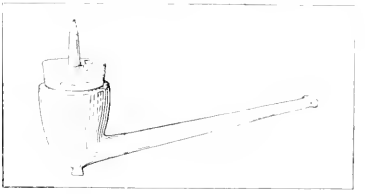
FIG. 2

Sectional View and Completed Boat

the small pipe A, is driven forcibly through the largest pipe, B, which carries with it a certain amount of air out through the opening C into the water. As the boat is driven forward by this force, the steam arises to the surface in the form of bubbles. The boat soon attains considerable speed, leaving behind a long wake.

Home-Made Blowpipe

Procure a clay pipe, a cork and a small glass or metal tube drawn to a small opening in one end. Make a hole in the cork just large enough to permit the tube to pass through tightly so no air can pass out except through the hole in the tube. Put the tube in the hole with the small opening at the top or projecting end. Push the cork into the

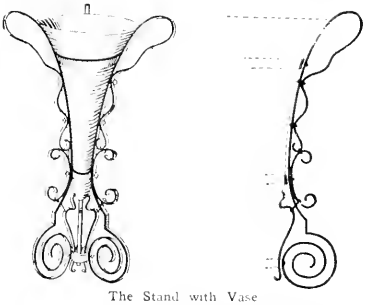


A Pipe Blowpipe

bowl of the pipe and the blowpipe is ready for use.—Contributed by Wilbur Cryderman, Walkerton, Ont.

Ornamental Iron Flower Stand

The illustration shows an ornamental iron stand constructed to hold a glass or china vase. This stand can be made by first drawing an outline of the vase on a heavy piece of paper. The vase is to have three supports. The shape of the scrolls forming each support should be drawn on the paper around the shape of the vase. A single line will be sufficient, but care must be taken to get the shapes of the scrolls



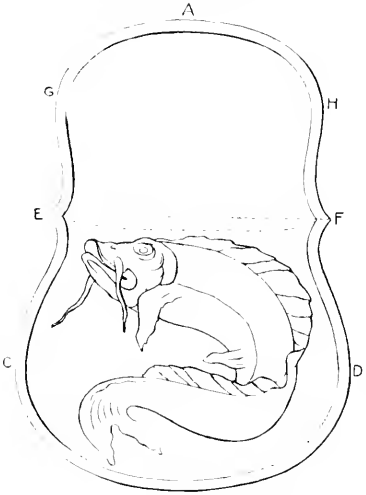
The Stand with Vase

true. Take a piece of string or, better still, a piece of small wire, and pass it around the scroll shape on the paper.

This will give the exact length of the iron required to make the scroll. As sheet metal is used for making the scrolls, it can be cut in the right lengths with a pair of tinner's shears. Take a pair of round-nose pliers, begin with the smallest scrolls, and bend each strip in shape, using the flat-nose pliers when necessary to keep the iron straight, placing it on the sketch from time to time to see that the scrolls are kept to the shape required. The scrolls are riveted and bolted together. The supports are fastened together with rings of strip iron $\frac{3}{8}$ in. wide, to which the supports are fastened with rivets. The metal can be covered with any desired color of enamel paint.

How to Make a Coin Purse

The dimensions for a leather coin purse are as follows: from A to B, as shown in the sketch, $6\frac{3}{8}$ in.; from C to D, $4\frac{1}{4}$ in.; from E to F, $3\frac{1}{2}$ in. and



Leather Design for a Purse

from G to H, $3\frac{1}{4}$ in. Russian calf modeling leather is the material used. A shade of brown is best as it does not soil easily, and does not require coloring.

Cut out the leather to the size of the pattern, then moisten the surface on the rough side with a sponge soaked in water. Be careful not to moisten the leather too much or the water will go through to the smooth side. Have the design drawn or traced on the pattern. Then lay the pattern on the smooth side of the leather and trace over the design with the small end of the leather tool or a hard, sharp pencil. Trace also the line around the purse. Dampen the leather as often as is necessary to keep it properly moistened.

After taking off the pattern, retrace the design directly on the leather to make it more distinct, using a duller point of the tool. Press or model down the leather all around the design, making it as smooth as possible with the round side of the tool. Work down the outside line of the design, thus raising it.

Fold the leather on the line EF. Cut another piece of leather the size of the side ECBD of the purse, and after putting the wrong sides of the leather together, stitch around the edge as designated by the letters above mentioned. Do not make this piece come quite up to the line EF, so that the coins may be more easily put in and taken out. About 1 in. from the lines EF on the piece, stitch in a strip of leather about $\frac{1}{4}$ in. wide when stitching up the purse, through which to slip the fly AGH.

A window glass may be kept from frosting by rubbing over the inner surface a solution of 55 parts of glycerine and 1,000 parts of 60 per cent alcohol. The odor may be improved by adding a little oil of amber. This solution will also prevent a glass from sweating in warm weather.

How to Make a Turbine Engine

In the following article is described a machine which anyone can make, and which will be very interesting, as well as useful. It can be made without the use of a lathe, or other tools usually out of reach of the amateur mechanic. It is neat and efficient, and a model for speed and power. Babbitt metal is the material used in its construction, being cast in wooden molds. The casing for the wheel is cast in halves—a fact which must be kept in mind.

First, procure a planed pine board 1 by 12 in. by 12 ft. long. Cut off six

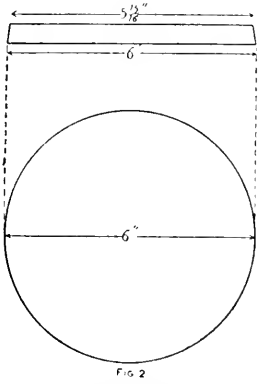


Fig. 2

pieces 12 in. square, and, with a compass saw, cut out one piece as shown in Fig. 1, following the dotted lines, leaving the lug a, and the projections B and b to be cut out with a pocket knife. Make the lug 1/4 in. deep, and the projections B, b, 1/2 in. deep. The entire cut should be slightly beveled.

Now take another piece of wood, and cut out a wheel, as shown in Fig. 2. This also should be slightly beveled. When it is finished, place it on one of the square pieces of wood, with the largest side down, then place the square piece out of which Fig. 1 was cut, around the wheel, with the open side down. (We shall call that side of a mold out of which a casting is drawn, the "open" side.) Place it so that it is even at the edge with the under square piece and place the wheel so that the space between the wheel and

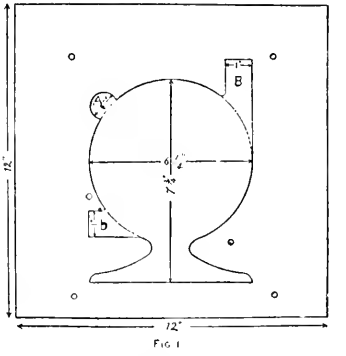


Fig. 1

the other piece of wood is an even 1/8 in. all the way around. Then nail the wheel down firmly, and tack the other piece slightly.

Procure a thin board 1/4 in. thick, and cut it out as shown in Fig. 3; then nail it, with pins or small nails, on the center of one of the square pieces of wood. Fit this to the two pieces just finished, with the thin wheel down—but first boring a 3/4-in. hole 1/4 in. deep, in the center of it; and boring a 3/8-in.

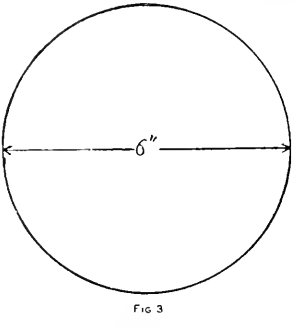


Fig. 3

hole entirely through at the same place. Now put mold No. 1 (for that is what we shall call this mold) in a vise, and bore six 1/4-in. holes through it. Be

careful to keep these holes well out in the solid part, as shown by the black dots in Fig. 1. Take the mold apart, and clean all the shavings out of it;

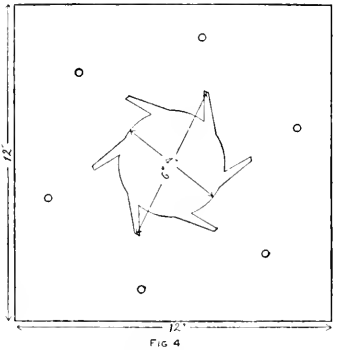


FIG 4

then bolt it together, and lay it away to dry.

Now take another of the 12-in. square pieces of wood, and cut it out as shown in Fig. 4, slightly beveled. After it is finished, place it between two of the 12-in. square pieces of wood, one of which should have a $^{3}/_{8}$-in. hole bored through its center. Then bolt together with six $^{1}/_{4}$-in. bolts, as shown by the

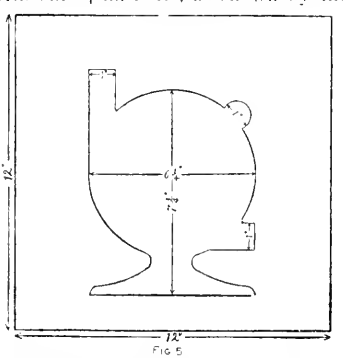


FIG 5

black dots in Fig. 4, and lay it away to dry. This is mold No. 2.

Now take mold No. 1; see that the bolts are all tight; lay it on a level place, and pour babbitt metal into it, until it is full. Let it stand for half an hour, then loosen the bolts and remove the casting.

Now cut out one of the 12-in.-square pieces of wood as shown in Fig. 5. This is the same as Fig. 1, only the one is left-handed, the other right-handed. Put this together in mold No. 1, instead of the right-handed piece; and run in babbitt metal again. The casting thus made will face together with the casting previously made.

Pour metal into mold No. 2. This will cast a paddle-wheel, which is intended to turn inside of the casting already made.

If there should happen to be any

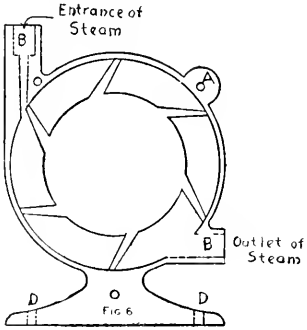


FIG 6

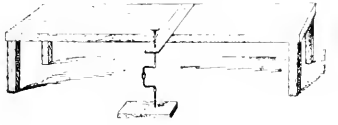
holes or spots, where the casting did not fill out, fill them by placing a small piece of wood with a hole in it, over the defective part, and pouring metal in to fill it up.

If you cannot obtain the use of a drill press, take an ordinary brace, fasten a $^{3}/_{8}$-in. drill in it, and bore a hole through the end of a strip about 2 in. wide and 16 in. long; put the top of the brace through this hole, and fasten the other end of the strip to a bench, as shown in illustration. Find the center of the paddle-wheel, place it under the drill, true it up with a square; and drill it entirely through. Find the centers of the insides of the other two castings, and drill them in the same manner.

A piece of mild steel 5 in. long, and $^{3}/_{8}$ in. in diameter must now be obtained. This is for a shaft. Commenc-

ing 1½ in. from the one end, file the shaft off flat for a distance of 1 in. Then cut a slot in the paddle-wheel, and place the shaft inside of the paddle-wheel, with the flat part of the shaft turned to face the slot in the wheel. Pour metal into the slot to key the wheel on to the shaft.

The paddle-wheel is now ready to be fitted inside of the casing. It may be necessary to file some of the ends off the paddles, in order to let the paddle-wheel go into the casing. After it is fitted in, so that it will turn easily, place the entire machine in a vise, and bore three ¼-in. holes, one in the lug, one in the projections, B, b, and the other in the base, as shown by the black dots in Fig. 6. Also bore the port-hole in projection B, and the exhaust hole in projection b, and two ¼-in. holes at d, d, Fig. 6. Cut out a piece of gasket and fit it between the two castings. Then bolt the castings together, screw down, and connect to the boiler.



Using the Brace

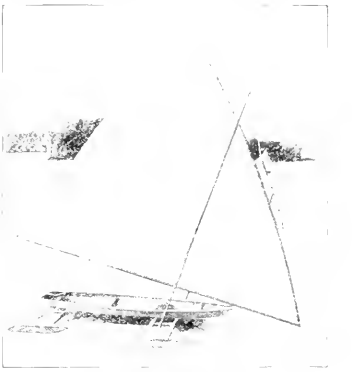
The reader must either cast a pulley out of babbitt metal, or else go to a machinist and get a collar turned, with a boss and a set screw, and with three small screw holes around the edge. Cut out a small wood wheel and screw the collar fast to it, fasten it to the shaft of the turbine and turn on the steam. Then take a knife or a chisel, and, while it is running at full speed, turn the wheel to the shape desired.

Your turbine engine is now ready for work, and if instructions have been carefully followed, will do good service.

When painting the automobile body and chassis be sure to stuff the oil holes with felt or waste before applying the paint. If this caution is not observed the holes will become clogged with paint which will prevent any oil reaching the bearing.

How To Build An Ice Boat

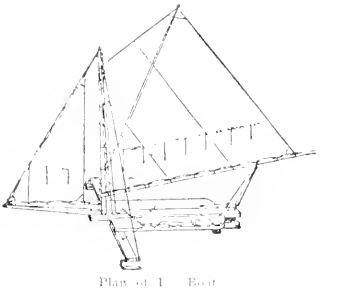
The ice boat is each year becoming more popular. Any one with even small experience in using tools can con-



A Four-Runner Ice Yacht

struct such a craft, and the pleasure many times repays the effort.

Take two pieces of wood 2 by 6 in., one 6 ft. and the other 8 ft. long. At each end of the 6 ft. piece and at right angles to it, bolt a piece of hardwood 2 by 1 by 12 in. Round off the lower edge of each piece to fit an old skate. Have a blacksmith bore holes through the top of the skates and screw one of them to each of the pieces of hardwood.



Plan of Ice Boat

These skates must be exactly parallel or there will be trouble the first time the craft is used.

Over the middle of the 6-ft. piece and

at right angles to it, bolt the 8-ft. plank, leaving 1 ft. projecting as in Fig. 1.

The rudder skate is fastened to a piece of hardwood 2 by 2 by 12 in. as the runners were fastened. This piece should be mortised 3 by 3 by 4 in. in the top before the skate is put on. Figure 2 shows the rudder post.

A piece of hardwood 1 by 6 by 6 in. should be screwed to the under side of the 8-ft. plank at the end with the grain running crosswise. Through this bore a hole $1\frac{1}{2}$ in. in diameter in order that the rudder post may fit nicely. The tiller, Fig. 3, should be of hardwood, and about 8 in. long.

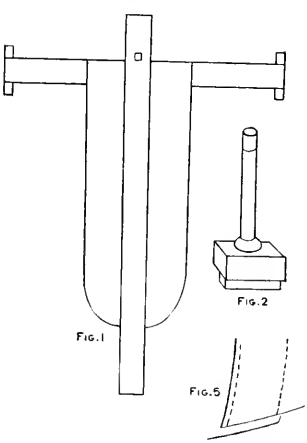
To the under side of the 8-ft. plank bolt a piece of timber 2 by 4 by 22 in. in front of the rudder block, and to this cross piece and the 6-ft. plank nail 8-in. boards to make the platform.

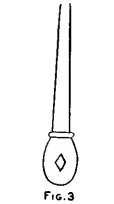
The spar should be 9 ft. long and $2\frac{1}{2}$ in. in diameter at the base, tapering to $1\frac{1}{2}$ in. at the top. This fits in the square hole, Fig. 4. The horn should be $5\frac{1}{2}$ ft. long, 2 by 3 in. at the butt and 1 in. at the end.

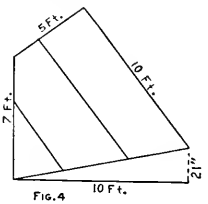
Figure 4 gives the shape and dimensions of the mainsail which can be made of muslin. Run the seam on a machine, put a stout cord in the hem and make loops at the corners.

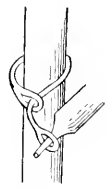
Figure 6 shows the way of rigging the gaff to the spar. Figure 7 shows the method of crotching the main boom and Fig. 8 a reef point knot, which may come in handy in heavy winds.

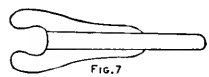
Make your runners as long as possible, and if a blacksmith will make an iron or steel runner for you, so much the better will be your boat.











Details of Ice Boat Construction

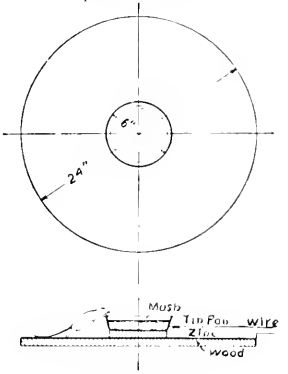
Electric Rat Exterminator

Some time ago we were troubled by numerous large rats around the shop, particularly in a storehouse about 100 ft. distant, where they often did considerable damage. One of the boys thought he would try a plan of electrical extermination, and in order to carry out his plan he picked up an old zinc floor plate that had been used under a stove and mounted a wooden disk 6 in. in diameter in the center. On this disk he placed a small tin pan about 6 in. in diameter, being careful that none of the fastening nails made an electrical connection between the zinc plate and the tin pan.

This apparatus was placed on the floor of the warehouse where it was plainly visible from a window in the shop where we worked and a wire was run from the pan and another from the

zinc plate through the intervening yard and into the shop. A good sized induction coil was through connected with these wires and about six dry batteries were used to run the induction coil whenever a push button was manipulated.

It is quite evident that when a rat put its two fore feet on the edge of the pan in order to eat the mush which it contained, that an electrical connection would be made through the body of the rat, and when we pushed the button up in the shop the rat would be thrown



Electric Rat Trap

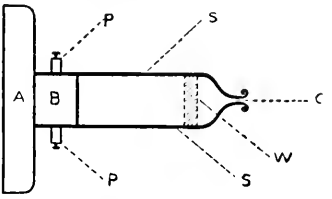
2 or 3 ft. in the air and let out a terrific squeak. The arrangement proved quite too effective, for after a week the rats all departed and the boys all regretted that their fun was at an end.—Contributed by John D. Adams, Phoenix, Ariz.

How to Make a Simple Fire Alarm

A fire alarm which is both inexpensive and simple in construction is shown in the illustration. Its parts are as follows:

A, small piece of wood; B, block of wood nailed to A; S S, two pieces of sheet brass about ¼ in. wide, bent into a hook at each end; P, P, binding-posts fastening the springs S S, to block B, so that they come in contact at C. W is a piece of wax crayon just long enough to break the contact at C when inserted as shown in the illustration.

When these parts have been put together in the manner described, connect the device in circuit with an electric bell, and place it behind a stove.

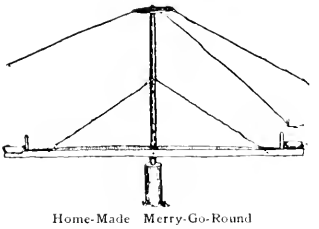


Simple Fire Alarm

When the stove becomes too hot the wax will melt at the ends, allowing the springs to contact at C, and the alarm bell will ring.—Contributed by J. R. Comstock, Mechanicsburg, Pa.

To Build a Merry-Go-Round

This is a very simple device, but one that will afford any amount of amusement. The center post rests in an auger hole bored in an old stump or in a post set in the ground. The stump makes the best support. The center pole should be 10 ft. high. An old wheel is mounted at the top of the pole, and the pole works in the wheel as an axle, says the American Boy. The wheel is anchored out by several guy

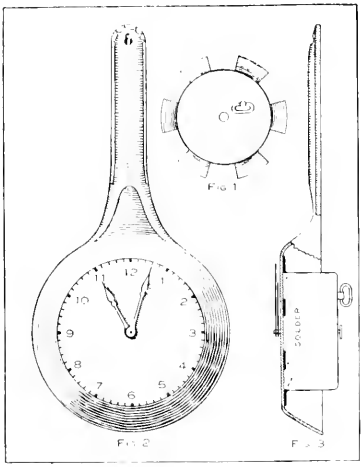

Home-Made Merry-Go-Round

wires. The seat arms may be any length desired. A passenger rides in each seat and the motorman takes his station at the middle.

Emery wheel arbors should be fitted with flanges or washers having a slight concave to their face.

Novelty Clock for the Kitchen

An inexpensive and easy way to make an unique ornament of a clock



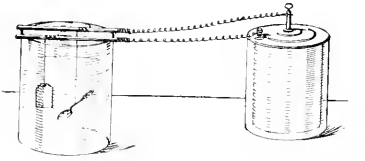
The Clock with Holder

for kitchen use is to take an old alarm clock or a new one if preferred, and make it into a clock to hang on the wall. Take the glass, dial and works out of the shell and cut some pieces out of the metal so that when the pieces left are turned back it will have the appearance as in Fig. 1. Then get a 10-cent frying pan, 6 in. in diameter, and drill a hole in the center so the shaft for the hands will easily pass through and extend out far enough to replace the two hands. Put the works back in the metal shell and solder it to the frying pan by the pieces turned out as in Fig. 2. Gild the pan all over, including the handle, and print black figures in the small circles. Calendar figures can be pasted on small circles and these pasted on the frying pan. The parts can be divided into minutes with small lines the same as shown in the drawing. Make new hands that are long enough to reach the figures from sheet brass or tin and paint them black.—Contributed by Carl P. Herd, Davenport, Iowa.

How to Make a Small Silver Plating Outfit

Take an ordinary glass fruit jar or any other receptacle in glass, not metal, which will hold 1 qt. of liquid and fill it with rain or distilled water and then add $\frac{3}{4}$ oz. of silver chloride and $1\frac{1}{2}$ oz. of c. p. potassium cyanide. Let this dissolve and incorporate well with the water before using. Take an ordinary wet battery and fasten two copper wires to the terminals and fasten the other ends of the wires to two pieces of heavy copper wire or $\frac{1}{4}$-in. brass pipe. The wires must be well soldered to the brass pipe to make a good connection. When the solution is made up and entirely dissolved the outfit is ready for plating.

Procure a small piece of silver, a silver button, ring, chain or anything made entirely of silver and fasten a small copper wire to it and hang on the brass pipe with connections to the carbon of the battery. Clean the article to be plated well with pumice and a brush saturated in water. When cleaning any article there should be a copper wire attached to it. Do not touch the article after you once start to clean it, or the places touched by your fingers will cause the silver plate to peel off when finished. When well scoured, run clear, cold water over the article and if it appears greasy, place in hot water. When well cleaned place in the plating bath and carefully watch the results. If small bubbles come to the surface you will know that you have too much of the anode or the piece of silver hanging in the solution and you



Plating Jar and Battery

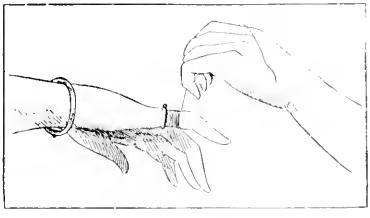
must draw out enough of the piece until you can see no more bubbles. Leave the piece to be plated in the solution

for about one-half hour, then take the article out and with a tooth brush and some pumice, clean the yellowish scum off, rinse in clear water and dry in sawdust. When thoroughly dry, take a cotton flannel rag and some polishing powder and polish the article. The article must have a fine polish before plating if it is desired to have a finely polished surface after the plate is put on.

In order to see if your battery is working, take a small copper wire and touch one end to the anode pipe and the other end to the pipe holding the article to be plated. When these two parts touch there will be a small spark. Always take the zincs out of the solution when not in use and the batteries will last longer. This description applies only to silver plating. Articles of lead, pewter, tin or any soft metal cannot be silver plated unless the article is first copper plated.

Removing a Tight-Fitting Ring from a Finger

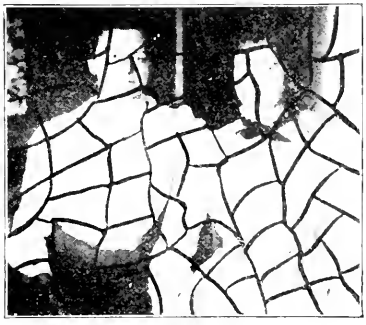
When a ring cannot be removed easily from the finger, take a string or thread and draw one end through between the ring and the flesh. Coil the other end of the string around the finger covering the part from the ring to and over the finger joint. Uncoil the string by taking the end placed through the ring and at the same time keep the ring close up to the string. In this way the ring can be easily slipped over the knuckle and off from the finger.—Contributed by J. K. Miller, Marietta, Penn.



Wrapping the Finger

A Photographic Jig-Saw Puzzle

Take any photographic print and mount it on heavy cardboard, or, if you have a jig saw, a thin smooth wood board and mark out various shaped pieces as shown in the accompanying cut. If the picture is mounted on cardboard, the lines can be cut through with a sharp pointed knife. If you have a jig saw, you can make a bromide enlargement from the negative you have selected and mount the print on a smooth board that is not too thick. This wood-mounted picture can be sawed out making all shapes of blocks, which forms a perfect jig-saw puzzle. —Contributed by Erich Lehmann, New York City.



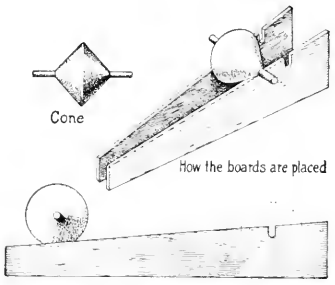
Picture Marked for Cutting

Rolling Uphill Illusion

This interesting as well as entertaining illusion, can be made by anyone having a wood-turning lathe. A solid, similar to two cones placed base to base, is accurately turned in a lathe, the sides sloping to an angle of 15 deg. The spindle can be turned out of the solid at the same time as the cone; or, after turning the cone, drive an iron or wood shaft through the center making a tight fit.

The boards for the track are made with a sloping edge on which the cone is to roll. This slope will depend on the diameter of the cone, which can be

any size from 3 to 12 in. The slope should not be too flat, or the cone will not roll, and it should be such that the



The Illusion

one end will be higher than the other by a little less than half the diameter of the cone. Thus it will be seen that the diameter of the cone determines the length of the slope of the tracks. A notch should be cut in the tracks, as indicated, for the shaft to drop into at the end of the course.

The lower end of the tracks are closed until the high edge of the cone rests upon the inside edges of the tracks and the high end spread sufficiently to take the full width of the cone and to allow the shaft to fall into the notches. When the cone and tracks are viewed from the broadside the deception will be more perfect, and will not be discovered until the construction of the model is seen from all sides. Should it be difficult to make the cone from wood, a good substitute can be made from two funnels.—Contributed by I. G. Bayley, Cape May Point, N. J.

Annealing Chisel Steel

Persons who have occasion to use tool or carbon steel now and then and do not have access to an assorted stock of this material find that the kind most readily obtained at the hardware store is the unannealed steel known as chisel steel. Machining or filing such steel is exceedingly slow and difficult, besides the destruction of tools; as a matter of fact this steel is intended for chisels, drills, and like tools which require only forging and filing. If this steel is annealed, it can be worked as easily as the more expensive annealed steel.

Annealing may be done by heating the steel to a cherry red, not any more, and burying it in a box of slaked lime, where it is allowed to remain until all the heat is gone. If well done, the metal will be comparatively soft and in a condition to machine easily and rapidly. In lieu of lime, bury in ashes, sand, loam, or any substance not inflammable, but fine enough to closely surround the steel and exclude the air so that the steel cools very slowly.

If possible, keep the steel red hot in the fire several hours, the longer the better. In certain processes, like that of file manufacturing, the steel blanks are kept hot for 48 hours or more. Where it is impossible to wait so long as the foregoing method takes, then a cold water anneal may be used with less time. This method consists of heating the work as slowly and thoroughly as the time will permit, then

The above photograph was made by first printing a maple leaf on the paper, not too dark, then printing on top the picture from the negative, and finished in the usual way.

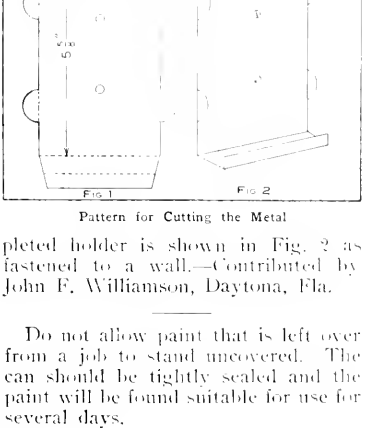
removing the steel from the fire and allowing it to cool in the air until black and then quenching in water.

In addition to softening the steel, annealing benefits the metal by relieving strains in the piece. Should a particularly accurate job be called for, the steel should be annealed again after the roughing cuts have been taken and before machining to the final size. This will insure a true job and diminishes the danger of spring in the final hardening.—Contributed by Donald A. Hampson, Middletown, N. Y.

How to Make a Post Card Holder

This holder is designed to lay flat on the counter or to stack one on top of the other, keeping each variety of cards separate, or a number of them can be fastened on any upright surface to display either horizontal or vertical cards.

The holders can be made from sheet tin, zinc, brass or aluminum. The dimensions for the right size are given in Fig. 1; the dotted line showing where the bends are made. The completed holder is shown in Fig. 2 as fastened to a wall.—Contributed by John F. Williamson, Daytona, Fla.



Pattern for Cutting the Metal

Do not allow paint that is left over from a job to stand uncovered. The can should be tightly sealed and the paint will be found suitable for use for several days.

Perfume-Making Outfit

The real perfume from the flowers is not always contained in the liquid purchased for perfume. The most expensive perfume can be made at home for less than 10 cents an ounce. The outfit necessary is a large bottle or glass jar with a smaller bottle to fit snugly into the open mouth of the large one. Secure a small piece of very fine sponge and wash it clean to thoroughly remove all grit and sand. Saturate the sponge with pure olive oil, do not use strong oil, and place it inside of the smaller bottle.

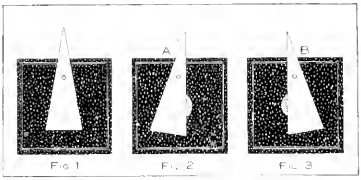
Fill the large bottle or jar with flowers, such as roses, carnations, pansies, honeysuckles or any flower having a strong and sweet odor. Place the small bottle containing the sponge upside down in the large one, as shown in the illustration.

The bottle is now placed in the sun and kept there for a day and then the flowers are removed and fresh ones put in. Change the flowers each day as long as they bloom. Remove the sponge and squeeze out the oil. For each drop of oil add 2 oz. of grain alcohol. If stronger perfume is desired add only 1 oz. alcohol to each drop of oil.

Home-Made Duplicator for Box Cameras

The projecting tube of the lens on a hand camera can be easily fitted with a duplicator while the box camera with its lens set on the inside and nothing but a hole in the box does not have such advantages. A small piece of heavy cardboard can be made to

produce the same results on a box camera as a first-class duplicator applied to a hand camera. The card-

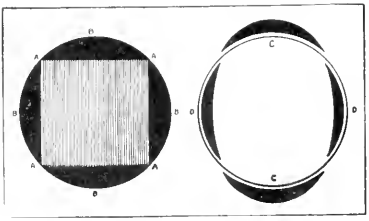


Duplicator Attached to a Camera

board is cut triangular and attached to the front end of the camera as shown in Fig. 1 with a pin about 1 in. above the lens opening. A rubber band placed around the lower end of the cardboard and camera holds the former at any position it is placed. A slight pressure of the finger on the point A, Fig. 2, will push the cardboard over and expose one-half of the plate and the same pressure at B, Fig. 3, will reverse the operation and expose the other one-half. Pins can be stuck in the end of the camera on each side of the lens opening at the right place to stop the cardboard for the exposure. With this device one can duplicate the picture of a person on the same negative.—Contributed by Maurice Baudier, New Orleans, La.

Optical Illusions

The accompanying sketch shows two optical illusions, the first having a perfect circle on the outside edge ap-



The Two Illusions

pears to be flattened at the points A, and the arcs of the circle, B, appear to be more rounding. In the second figure the circle appears to have an oval form with the distance from C to C greater than from D to D. A compass applied to the circles in either figures will show that they are perfectly round.—Contributed by Norman S. Brown, Chippewa Falls, Wis.

Use of Kerosene in Polishing Metals

Anyone who has polished a flat iron or steel surface with emery cloth knows how soon the cloth gums and fills up. The cloth in this condition will do little or no cutting. A simple remedy for this trouble is to use kerosene on the surface. The oil floats away a large part of the gumming substance and leaves the emery cloth sharp and clean to do the best work, also, it seems to act as a lubricant to keep particles of metal from collecting on the cloth and scratching or digging in the surface of the metal. A very light lard oil is equally good for this purpose, but not always easily obtained. A surface polished where oil or kerosene is used does not rust so easily as one polished dry, for the reason that a little oil remains on the metal.

Kerosene is the best to use on oil stones, being better than heavier oil. This oil readily floats away all particles of the feather edge that are liable to become loosened and forced into the stone. These particles of metal when stuck to the stone are the cause of spoiling it, as well as nicking the tools that are being sharpened. Keep the surface of the stone well oiled at all times to make the cutting free.—Contributed by Donald A. Hampson, Middletown, N. Y.

How to Make Lamps Burn Brightly

For a good, steady light there is nothing better than a lamp, but like most everything it must have attention. After cleaning well and fitting it, place a small lump of camphor in the oil vessel. This will greatly improve the light and make the flame clearer and brighter. If there is no camphor at hand add a few drops of vinegar occasionally.

A Practical Camera for Fifty Cents

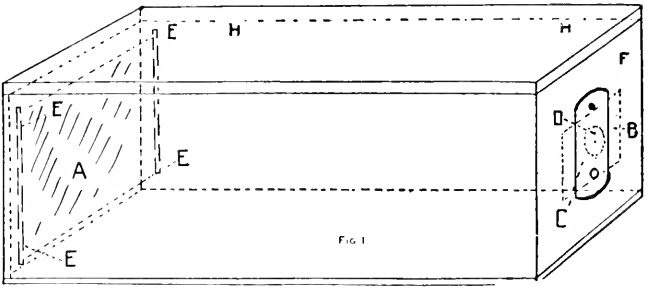
By C. H. Claudy

I say for fifty cents, but really this is an outside estimate. If you possess a few tools and the rudiments of a shop, by which is meant a few odds and ends of screws, brass and nails, you can really make this camera for nothing.

The camera box is the first consideration, and for this a cigar box answers every purpose. It is better to use one of the long boxes which contain a hundred cigars and which have square ends. This box should be cut down, by means of a saw and a plate, until the ends are 4 in. square. Leave the lid hinged as it is when it comes. Clean all the paper from the outside and inside of the box—which may be readily done with a piece of glass for a scraper and a damp cloth—and paint the interior of the box a dead black, either with carriage makers' black or black ink.

Now bore in the center of one end a small hole, $\frac{1}{4}$ in. or less in diameter. Finally insert on the inside of the box, on the sides, two small strips of wood, $\frac{1}{8}$ by $\frac{1}{4}$ in. and fasten them with glue, $\frac{1}{8}$ in. from the other end of the box. Examine Fig. 1, and see the location of these strips, which are lettered EE. Their purpose is to hold the plate, which may be any size desired up to 4 in. square. Commercially, plates come $3\frac{1}{2}$ by $3\frac{1}{2}$ in., or, in the lantern slide plate, $3\frac{1}{4}$ by 4 in. If it is desired to use the $3\frac{1}{2}$ by $3\frac{1}{2}$ in. plates, which is advised, the box should measure that size in its internal dimensions.

We now come to the construction of the most essential part of the camera—the pin hole and the shutter, which take the place of the lens and shutter used in more expensive outfits. This construction is illustrated in Fig. 4. Take a piece of brass, about 1/16 in. thick and $1\frac{1}{2}$ in. square. Bore a hole in each corner, to take a small screw, which will fasten it to the front of the camera. With $\frac{1}{4}$-in. drill bore nearly through the plate in the center, but be careful that the point of the drill does not come through. This will produce



Construction of Camera Box

the recess shown in the first section in Fig. 4. Now take a No. 10 needle, insert the eye end in a piece of wood and very carefully and gently twirl it in the center of the brass where it is the thinnest, until it goes through. This pin hole, as it is called, is what produces the image on the sensitive plate, in a manner which I shall presently describe. The shutter consists of a little swinging piece of brass completely covering the recess and pin hole, and provided with a little knob at its lower end. See Fig. 3, in which F is the front of the camera, B the brass plate and C the shutter. This is also illustrated in the second cross section in Fig. 4. In the latter I have depicted it as swung from a pivot in the brass, and in Fig. 3 as hung from a screw in the wood of

the front board; either construction will be effective.

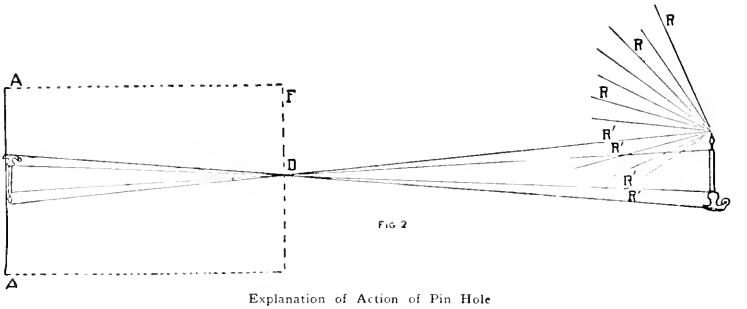


FIG 2

Explanation of Action of Pin Hole

Lastly, it is necessary to provide a finder for this camera in order to know what picture you are taking. Make a little frame of wire, the size of the plate you are using, and mount it upright (see Fig. 5) on top of the camera as close to the end where the pin hole is as you can. At the other end, in the center, erect a little pole of wire half the height of the plate. If now you look along the top of this little pole, through the wire frame and see that the top of the little pole appears in the center of the frame, everything that you see beyond will be taken on the plate, as will be made plain by looking at the dotted lines in Fig. 5, which represents the outer limits of your vision when confined within the little frame.

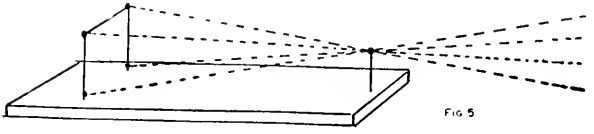


FIG 5

Constructing a Finder for Camera

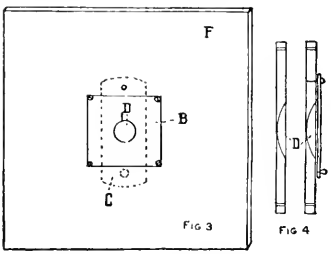


FIG 3

FIG 4

Pin Hole and Shutter Construction

When you want to use this camera, take it into an absolutely dark room and insert a plate (which you can buy at any supply store for photographers) in the end where the slides of wood are, and between them and the back of the box. Close the lid and secure it with a couple of rubber bands. See that the little shutter covers the hole. Now take the camera to where you wish to take a photograph, and rest it securely on some solid surface. The exposure will be, in bright sunlight and supposing that your camera is 10 in. long, about six to eight seconds. This exposure is made by lifting the little brass shutter until the hole is uncovered, keeping it up the required time, and then letting it drop back into place. It is important that the camera be held rigid during the exposure, and that it does not move and is not jarred —otherwise the picture will be blurred. Remove the plate in the dark room and pack it carefully in a pasteboard box and several wrappings of paper to protect it absolutely from the light. It is now ready to be carried to some one

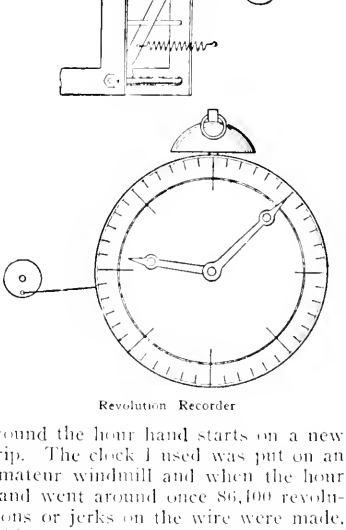
who knows how to do developing and printing.

To explain the action of the pin hole I would direct attention to Fig. 2. Here F represents the front of the camera, D the pin hole, AA the plate and the letters RR, rays from a lighted candle. These rays of course, radiate in all directions, an infinite multitude of them. Similar rays radiate from every point of the object, from light reflected from these points. Certain of these rays strike the pin hole in the front of the camera, represented here by RRRR. These rays pass through the pin hole, and as light travels only in straight lines, reach the plate AA, forming an inverted image of the object, in this case a candle in a candlestick. Millions of rays are given off by every point in every object which is lighted by either direct or reflected light. To all practical purposes only one of these rays from each point in an object can pass through a minute opening like a pin hole. This being so, any screen which interrupts these selected rays of light will show upon it a picture of the object, only inverted. If that screen happens to be a photographically sensitive plate, which is protected from all other light by being in a dark box, upon it will be imprinted a photographic image which can be made visible by the application of certain chemicals, when it becomes a negative, from which may be printed positives. This camera is not a theoretical possibility, but an actual fact. I have made and used one successfully, as a demonstration of pin-hole photography.

Use for an Old Clock

Remove the hair spring of the clock, and fasten a spring to one end of the pawl and a small wire to the other end. Make a slit in the case of the clock opposite the pawl. Fasten the spring on the outside in any convenient way and pass the wire through the slit to an eccentric or other oscillating body.

To make the dial, paste a piece of paper over the old dial, pull the wire back and forth one hundred times, and make a mark where the minute hand stops. Using this for a unit divide up the whole dial. The hour hand has an inner circle of its own. Put the alarm hand at a little before twelve and wind the alarm. When the alarm is unwound the hour hand starts on a new trip. The clock I used was put on an amateur windmill and when the hour hand went around once 86,400 revolutions or jerks on the wire were made, while the minute hand recorded one-twelfth of this number, or 7,200.—Contributed by Richard H. Ranger, Indianapolis, Ind.



Revolution Recorder

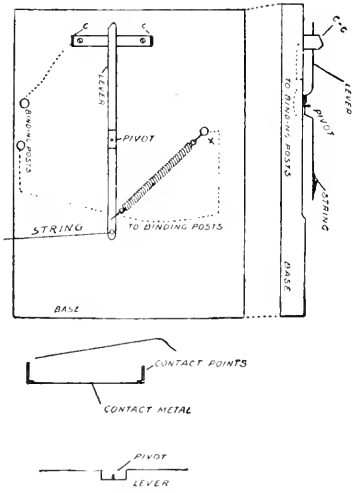
Renewing Dry Batteries

Dry batteries, if not too far gone, can be renewed by simply boring a small hole through the composition on top of each carbon and pouring some strong salt water or sal ammoniac solution into the holes. This kink is sent us by a reader who says that the process will make the battery nearly as good as new if it is not too far gone beforehand.

If a round brush spreads too much, slip a rubber band over the upper part of the bristles.

How to Make a Simple Burglar Alarm

Take a piece of any wood about 6 by 8 in. for the base. This may be finished in any way desired. For the contact points use brass or any sheet metal



Simple Burglar Alarm

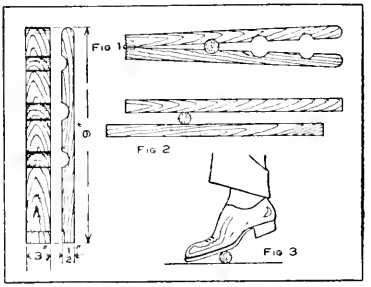
which will be satisfactory. Take a piece about 2½ or 3 in. in length and bend the ends up about ½ in. in a vertical position as shown. Fasten this to the top of the board using screws or nails. Under this strip of metal fasten a copper wire which can be connected to a binding-post on the board if desired. Take another piece of metal about 4½ in. in length and make a lever of it in the shape shown in the diagram. Fasten this so that one end of it will swing freely, but not loosely between the ends of the other piece marked C-C. Near the end fasten a spiral spring, S, which can be obtained almost anywhere. Fasten the end of this to the screw marked X. Also fasten to this screw a copper wire leading to the binding-post. In the lower end of the lever make a small hole to fasten a string through.

This string may be fastened across a door or window and any movement of it will pull it to the contact point on the right. If the string is cut or broken the spring will pull the lever to the contact point on the left and thus complete the circuit. If the string is burned it will also act as a fire alarm.

How to Fit Corks

Occasionally odd-sized bottles are received in stores which require corks cut to fit them. No matter how sharp a knife may be, it will leave some sharp edges after cutting the cork, which will cause leakage. The illustration shows three very effective methods of reducing the size of corks. The one shown in Fig. 1 is made from two pieces of ½-in. wood fastened together at one end with a common hinge. Two or three grooves are cut cross-wise in sizes desired. The cork is put into the groove and both pieces are pressed together, which will make the cork smaller.

Rolling the cork between two flat



Three Methods for Reducing Size of Corks

surfaces (Fig. 2) is simple and almost as good as pressing in the grooves. A cork rolled on the floor (Fig. 3) is a quick and effective way. A slower and equally as good way is to soak the cork in hot water for a short time.—Contributed by L. Szerlip, Brooklyn, N. Y.

Standing at the cylinder end and looking toward the flywheel of an engine, the wheel will be at the right if the engine is right-hand.

Home-Made Crutch

While a fractured bone was healing in the limb of my boy he needed a pair of crutches and not being able to secure the right length, I set about to make the crutches from two broom handles. I split the handles to within 1 ft. of the end (Fig. 1) with a rip saw, and then stuck them in a barrel of water for three days to make the wood pliable for bending. A grip for each stick was made as long as the hand is wide and a hole bored through the center the size of a No. 10 gauge wire. These grips were placed between the two halves of each stick at the right distance for the length of the boy's arm and a wire run through both split

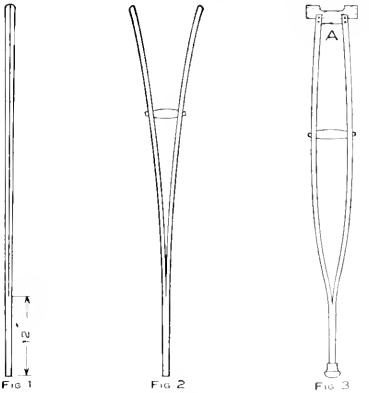


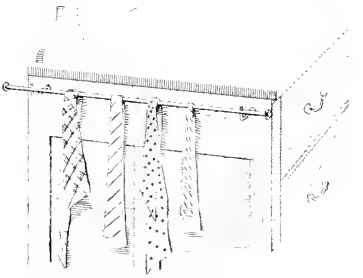
FIG 1 FIG 2 FIG 3

A Broom Handle Crutch

pieces and the handle then riveted as shown in Fig. 2. Another piece was cut as shown at A, Fig. 3, and nailed to the upper ends of each half of the broom handle.—Contributed by Geo P. Grehore, Nashville, Tenn.

Home-Made Necktie Holder

The gas bracket is considered a good place to hang neckties, even if it does crowd them together. The illustration shows a better method, a curtain rod attached to one end of a bureau. Two long-shanked, square-hooked screws should be used, so they may be screwed beneath and close up to the projecting top. When removed they will leave no



Hanger for Ties

disfiguring holes. Contributed by C W. Neiman, New York City.

How to Make a Trousers Hanger

Secure from your tinsmith a piece of sheet metal 7 in. wide and 12 in. long. Cut the metal as shown in Fig. 1 and make a close bend at the point A, but not too close to cause it to break. The piece will then appear as shown in Fig. 2. Cut a piece from the waste material $\frac{1}{2}$ in. wide and $2\frac{1}{4}$ in. long and bend it around the two pieces B, Fig. 2, so it will slide freely on their length. Bend the edges C in for $\frac{1}{8}$ in. to hold the trousers firmly. Drill a hole through the top end of B and attach a wire formed into a hook for use in hanging on a nail. The bottom end of the trousers is inserted between the jaws C and the small ferrule pushed

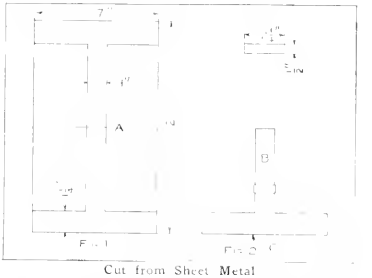


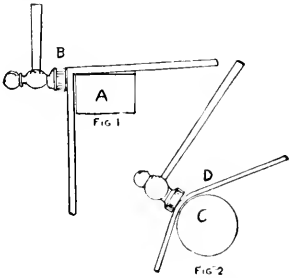
FIG. 1 FIG. 2

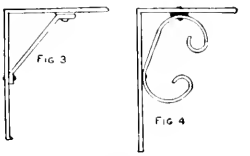
Cut from Sheet Metal

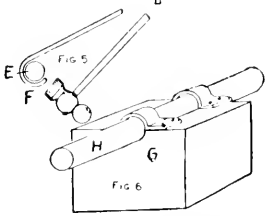
down to clamp them on the cloth.—Contributed by A. Levinson, Saginaw, Michigan.

Easy Designs in Ornamental Iron Work

Many an industrious lad has made money manufacturing the common forms of wood brackets, shelves, boxes, stands, etc., but the day of the scroll saw and the cigar-box wood bracket and picture frame has given way to the more advanced and more profitable work of metal construction. Metal brackets, stands for lamps, gates, parts of artistic fences for gardens, supporting arms for signs, etc., are among the articles of modern times that come under the head of things possible to construct of iron in the back room or attic shop. The accompanying sketches present some of the articles possible to manufacture.







First, it is essential that a light room be available, or a portion of the cellar where there is light, or a workshop may be built in the yard. Buy a moderate sized anvil, a vise and a few other tools, including bell hammer, and this is all required for cold bending. If you go into a forge for hot bending, other devices will be needed. Figure 1 shows how to make the square bend, getting the shoulder even. The strip metal is secured at the hardware store or the iron works. Often the strips can be secured at low cost from junk dealers. Metal strips about ½ in. wide and ⅛ in. thick are preferable. The letter A indicates a square section of iron, though an anvil would do, or the base of a section of railroad iron. The bend is worked on the corner as at B, cold. If a rounded bend is desired, the same process is applied on the circular piece of iron or the horn of an anvil. This is shown in Fig. 2, at C. This piece of iron can be purchased at any junk store, where various pieces are always strewn about. A piece about 20 in. long and 4 in. in diameter is about the right size. The bend in the metal begins at D and is made according to the requirements. Occasionally where sharp bends or abrupt corners are needed, the metal is heated previous to bending.

Although the worker may produce various forms of strip-metal work, the bracket is, as a rule, the most profitable to handle. The plain bracket is shown in Fig. 3, and is made by bending the strip at the proper angle on form A, after which the brace is adjusted by means of rivets. A rivet hole boring tool will be needed. A small metal turning or drilling lathe can be purchased for a few dollars and operated by hand for the boring, or a common hand drill can be used. Sometimes the bracket is improved in design by adding a few curves to the end pieces of the brace, making the effect as shown in Fig. 4. After these brackets are made they are coated with asphaltum or Japan; or the brackets may be painted or stained any desired shade.

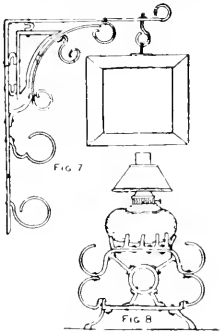
In some of the work required, it is necessary to shape a complete loop or circle at the end of the piece. This may

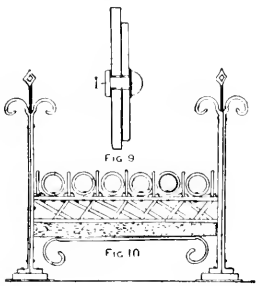
be wrought out as in Fig. 5. The use of a bar of iron or steel is as shown. The bar is usually about 2 in. in diameter and several feet in length, so that it will rest firmly on a base of wood or stone. Then the bending is effected as at F, about the bar E, by repeated blows with the hammer. After a little practice, it is possible to describe almost any kind of a circle with the tools. The bar can be bought at an iron dealers for about 40 cents. From the junk pile of junk shop one may get a like bar for a few cents.

A convenient form for shaping strip-metal into pieces required for brackets, fences, gates, arches, and general trimmings is illustrated at Fig. 6. First there ought to be a base block, G, of hard wood, say about 2 ft. square. With a round point or gouging chisel work out the groove to the size of the bar, forming a seat, by sinking the bar, H, one-half its depth into the wood as shown. In order to retain the bar securely in position in the groove, there should be two caps fitted over it and set-screwed to the wooden base. These caps may be found in junk dealers' heaps, having been cast off from 2-in. shaft boxes. Or if caps are not available, the caps can be constructed from sheet metal by bending to the form of the bar, allowing side portions or lips for boring, so that the caps can be set-screwed to the wood. Thus we get a tool which can be used on the bench for the purpose of effecting series of bends in strips of metal.

Since the introduction of the laws requiring that signs of certain size and projection be removed from public thoroughfares in cities, there has been quite a call for short sign brackets, so termed, of the order exhibited in Fig. 7. These sign-supporting brackets do not extend more than 3 ft. out from the building. A boy can take orders for these signs in almost any city or large town with a little canvassing. The sign supporting bracket shown is merely a suggestion. Other designs may be wrought out in endless variety. A hook or eye is needed to sustain the ring in the sign.

The young man who undertakes to construct any sort of bracket, supports, frames or the like, will find that he will get many orders for lamp-supporting contrivances, such as shown at Fig. 8. It is hardly necessary to go into details





for making these stands, as every part is bent as described in connection with the bending forms, and the portions are simply riveted at the different junctures. Both iron and copper rivets are used as at I, in Fig. 9, a cross sectional view.

The best way is to bore straight through both pieces and insert the rivet. In some cases the rivet is headed up in the bore and again washers are used and the heading effected on the washer. Copper rivets are soft and easily handled, but are costly as compared with iron rivets.

Good prices are obtained for the guards for open fireplaces made in many varieties in these days. The re-

turn of the open fireplace in modern houses has created a demand for these guards and in Fig. 10 we show a design for one of them. The posts are made

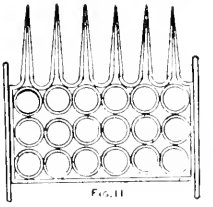


FIG. 11

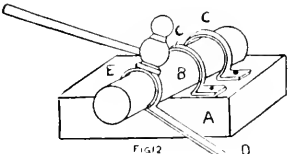


FIG. 12

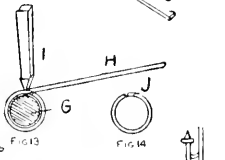


FIG. 13 FIG. 14

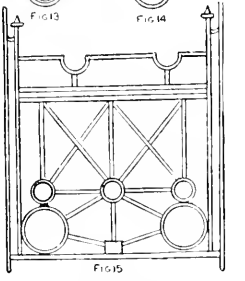


FIG. 15

sufficiently stiff by uniting two sides with rivets. The ends at top are looped as shown, while the ends or butts at the base are opened out to make the feet. Rings are shaped on forms and are then riveted to the base cross-piece as illustrated. Crosses are made to describe to central design and the plan is worked out quite readily with the different shapes.

The making of metal fire grate fronts has proven to be a very interesting and profitable occupation for boys in recent times. Not long ago it was sufficient for the ingenious youth to turn out juvenile windmills, toy houses and various little knickknacks for amusement. The modern lad wants more than this. He desires to turn some of his product into cash. Therefore we present some of the patterns of fire grates which boys have made and can make again from scrap iron, with few tools and devices, and find a ready market for the same as soon as they are made. Figure 11 is a sketch of a form of fire grate bar or front that is constructed with a series of circles of strip metal. The best way is to go to the hardware store or iron dealer's and buy a quantity of $\frac{1}{4}$-in., $\frac{1}{2}$-in., and $\frac{3}{4}$-in. iron, about $\frac{1}{8}$ to $\frac{3}{16}$-in. thick. In fact $\frac{1}{16}$-in. metal would do in many cases where the parts are worked out small in size. The $\frac{1}{8}$-in. metal is very strong. Then after getting the supply of strip metal in stock, procure the usual type of metal worker's hammer, a cheap anvil, a 9-lb. vise, a cold chisel, a file or two, and a round piece of shaft iron, about 3 in. diameter and 2 to 3 ft. long. This piece of iron is represented at B, Fig. 12.

The iron is held in position by means of the straps of metal C, C, which are bent over the shaft tightly and grip the board base with set or lag screws as shown. The wooden base should be about 2 in. thick and large enough to make a good support for the iron shaft. The process of bending the rings in this way is as shown. The piece of strip iron is grasped at D. Then with the hammer the iron is gradually worked cold about the mandrel as at E until the perfect form is acquired. After the form is finished, the strip at the terminus of the ring is cut off. In order to get a steady base the wooden part may be bolted to a bench. In Fig. 13 is shown the method of clipping off the completed ring. The cold chisel is held upright, and by delivering several blows with the hammer upon the same, the point is caused to chip through the metal and release the ring. The shaft or mandrel is marked G. The cold chisel is indicated at I and the position

where the hand grasps the strip is at H. The final operation in shaping the ring is by driving the protruding cut, lip down, to the common level of the opposite point, thus giving us the finished ring with the lips closed on the mandrel as at J, Fig. 14. These rings can be turned out in this way very speedily. The next operation involves the process of uniting the rings in the plan to shape the design. The design work is often worked out ahead and followed. Some become so proficient that they can develop a design as they proceed.

Figure 11 is a design of grate front used for various purposes in connection with grate fires. The series of rings are united by a rivet between each at the joining point. With thin metal the holes can be punched with an iron punch and hammer on an anvil where there is a hole to receive the point of the punch after the punch penetrates the metal. For the heavier forms of metal a drill is necessary. A metal drill and brace can be purchased very cheaply for this work. After drilling the holes, the parts are erected and the rivets inserted and headed up as each addition is made. Thus the series of rings are united and then the side pieces are similarly riveted. The points at the top are then worked out and joined on. These points are filed down to the necessary taper after the union is effected. The finishing work involves smoothing rough places with a file and painting. Asphaltum makes a good black finish. Some of the best designs of grates are bronzed. Some are silvered. The different designs are finished as desired by customers.

Figure 15 is another design of grate in which the process of shaping the rings is like that in the first design. There are some half circles in this pattern and these are framed by shaping the same about the mandrel with the hammer. In order to get the shoulders close and the circle complete it is necessary to heat the metal. A coke fire can be made in a hole in the ground. Then procure a tin blowpipe and blow the flame against the metal at the point to be bent. This metal will become red hot very soon, and can be bent readily against the anvil and the circular form. Let the metal cool off on the ground after heating. Fig. 16 is another design

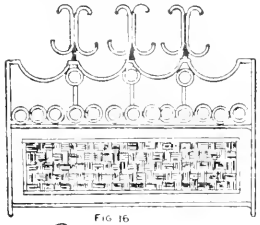


FIG 16

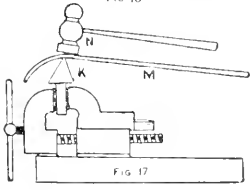


FIG 17

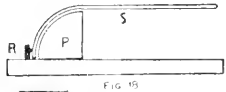


FIG 18

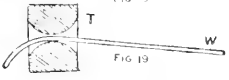


FIG 19

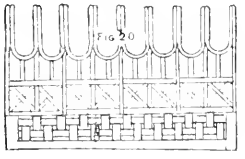


FIG 20

which can be wrought out. The middle adjustment is wire screen work which may be bought at a hardware store and set into the position shown. Fig. 17 shows a clipping off device useful in connection with this work. Metal clippers can be bought at any tool store. The clipper is placed in the jaws of the vise A at K, and secured there. The strip of metal in process of cutting is marked M. The hammer head is caused to strike the metal just over the cutting edge of the clipper. The quick,

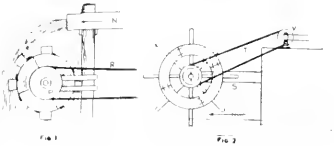
hard blow causes the cutting edge to penetrate far enough to sever the piece. Bending cold with a wooden form is done as in Fig. 18. The wooden form is marked F and is about 8 in. wide and 3 in. high, forming a one-sided oval shape. There is a pin K set into the base board of the oval form and the strip of metal for bending is grasped at S and the other end is inserted back of the pin K. By applying pressure, the strip of metal is bent to the form.

Figure 19 shows the hour-glass wood bending form, made by selecting a piece of hard wood block, about 6 in. square and boring through with an inch bit. Then the hole is shaped hour-glass like. The view is a sectional one. The block is placed in a vise and the strip for bending is inserted as at T.

The strip of metal is grasped at W and can be bent to various forms by exerting pressure. Fig. 20 is another type of fireplace front, constructed by uniting the shaped metal pieces. In fact an almost endless variety of designs can be wrought out after the start is once made. A good way to figure the price on the grate is to add up the costs of the parts and charge about 12 cents per hour for the work.

How to Make a Water Wheel

Considerable power can be developed with an overshot water wheel erected as in Fig. 1. This wheel is made with blocks of wood cut out in sections as indicated by the lines, so as to form the circle properly. The wheel can be



Overshot and Undershot Wheels

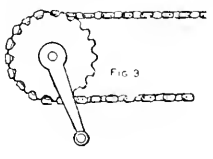
about 24 in. in diameter to produce results and about 10 in. wide. Get some tin cans and attach them around the wheel as shown. Bore the wheel center out and put on the grooved wood wheel, P, and a rope for driving, R. This rope runs to a wooden frame in the manner illustrated. The water is carried in a sluice affair, N, to the fall, O, where the water dippers are struck by the volume and from 2 to 4 hp. will be produced with this size of wheel if there is sufficient flow of water. This power can be used for running two or three sewing machines, fans, fret-saws, and the like. Another form of water wheel is shown in Fig. 2. This is driven by an underflow of current. This type of wheel can be made on lines similar to the other, only that the paddles are of wood and extend outward as shown. The wheel is supported in a bearing on the piece S. A belt, T, communicates the power to the wheel V and from here the power is carried to any desired point.

How To Build An Imitation Street Car Line

An imitation street car line may sound like a big undertaking, but, in fact, it is one of the easiest things a boy can construct, does not take much time and the expense is not great. A boy who lives on a farm can find many fine places to run such a line, and one in town can have a line between the house and the barn, if they are some distance apart.

Often all the boards and blocks required can be had for helping a carpenter clear away the rubbish around a new building. Wheels and parts of old bicycles, which can be used in so many ways, can be found at a junk shop at very low prices, wheels in good repair are not expensive. For the car for the street car line try to find a set of wheels having axles, but if you cannot find such, make shafts of hard wood, about 3 in. by 2½ in. and by means of a jackknife turn, or shave down the ends to receive the hub bearings of the wheels. Fasten the wheel hubs securely over

the ends of the wood with pins or little bolts, or if the wheel bearing is of such a nature that it revolves on its own journal, the journal can be fastened to the end of the wood piece. Each of the wheels should be provided with a sprocket; any chain sprocket of a bicycle may be used. Fasten these sprockets on the outside of the wheels as shown in Fig. 1. They can be set on over the bearing end and secured with a set screw, or the original key can be employed. It is best in cases like this to use the original parts. Make the floor of the car of pieces of boards placed on the axles and nailed, screwed or bolted, as shown at A. To erect the frame, place uprights, C C C C, in position as shown, fastening the ends to the base-boards, and making the roof line as at B, then put in the cross-pieces, G G. Seats, E E, are simply boxes. The drive of the car is effected by using the driving sprockets, D D, fitted to the crosspieces, G G, with the original bearings. The parts are thereby secured to the car and the chain placed on.



Key the cranks for turning to the upper sprocket's shaft and all is ready. If there are sprocket gears and cranks on either side, four boys may propel the car at one time. Considerable speed can be made on smooth roads, but it is the best amusement to run a car line on wooden tracks with a brake consisting of a piece of wooden shaft, passing through a bore in the car floor, and fitted with a leather covered pad as at H. A spiral spring holds up the brake until pressure is applied by foot power, when the brake contacts with the wooden track and checks the car.

The track plan is illustrated in Fig 2. Get some boards and place them end for end on other pieces set as ties. The main boards or tracks, J J, can be about 6 in. wide, to the edges of which nail strips about ¾ in. wide and about the same height. The ties, I I, can be almost any box boards. Wire nails are the best to use in putting the tracks together. The sprocket connection with the chain is shown in Fig. 3. This consists of the sprocket gear on the propelling shaft, and the crank. The pedals may be removed and a chisel handle, or any tool handle, substituted, so as to afford means for turning the crank by hand power. Great fun can be had with the road, and, furthermore, it can be made remunerative, as boys and girls can be given rides for a penny each.

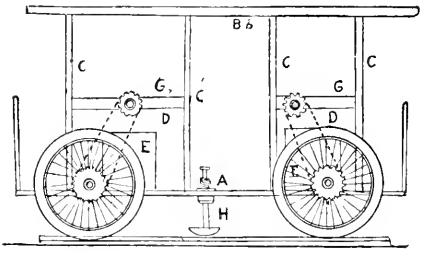


Fig 1
Construction of Car

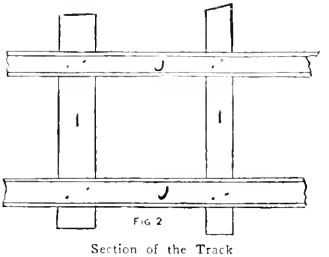


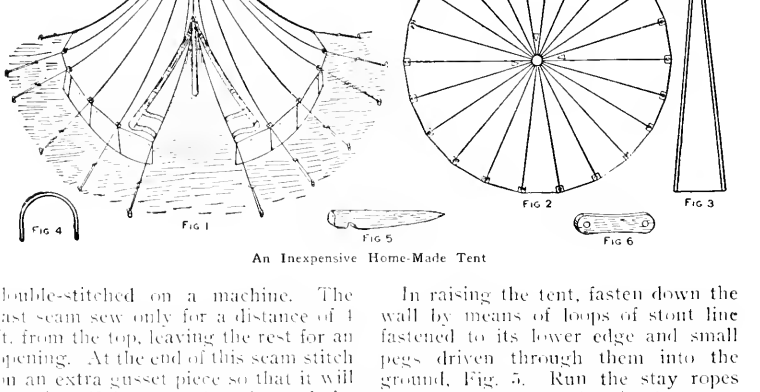
Fig 2
Section of the Track

Apply a coat of raw starch water to a dirty wall before painting; this, when dry, may be brushed or wiped off.

A good varnish for electric terminals is made of sealing wax dissolved in gasoline. To prevent brittleness add a little linseed oil.

How to Make a Bell Tent

A bell tent is easily made and is nice for lawns, as well as for a boy's camping outfit. The illustrations show a plan of a tent 14 ft. in diameter. To make such a tent, procure unbleached tent duck, which is the very best material for the purpose, says the Cleveland Plain Dealer. Make 22 sections, shaped like Fig. 3, each 10 ft. 6 in. long and 2 ft. 2 in. wide at the bottom, tapering in a straight line to a point at the top. These dimensions allow for the laid or lapped seams, which should be



An Inexpensive Home-Made Tent

double-stitched on a machine. The last seam sew only for a distance of 4 ft. from the top, leaving the rest for an opening. At the end of this seam stitch on an extra gusset piece so that it will not rip. Fold back the edges of the opening and the bottom edge of the bell-shaped cover and bind it with wide webbing, 3 in. across and having eyelets at the seams for attaching the stay ropes. Near the apex of the cover cut three triangular holes 8 in. long and 4 in. wide at the bottom and hem the edges. These are ventilators. Make the tent wall of the same kind of cloth 2 ft. 2 in high. Bind it at the upper edge with webbing and at the bottom with canvas. Also stitch on coarse canvas 6 in. wide at the bottom, and the space between the ground and the wall when the tent is raised, fill with canvas edging. Stitch the upper edge of the wall firmly to the bell cover at the point indicated by the dotted line, Fig. 2.

For the top of the tent have the blacksmith make a hoop of ¼-in. round galvanized iron, 6 in. diameter. Stitch the canvas at the apex around the hoop and along the sides. Make the apex into a hood and line it with stiff canvas. Have the tent pole 3 in. in diameter, made in two sections, with a socket joint and rounded at the top to fit into the apex of the tent.

In raising the tent, fasten down the wall by means of loops of stout line fastened to its lower edge and small pegs driven through them into the ground, Fig. 5. Run the stay ropes from the eyelets in the circular cover to stakes (Fig. 5) stuck in the ground. Use blocks, as in Fig. 6, on the stay ropes for holding the ends and adjusting the length of the ropes.

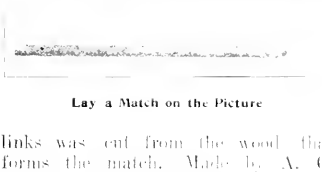
Simple X-Ray Experiment

The outlines of the bones of the hand may be seen by holding a piece of rice paper before the eyes and placing the spare hand about 12 in. back of the rice paper and before a bright light. The bony structure will be clearly distinguishable.—Contributed by G. J. Tress, Emsworth, Pa.

Mechanics for Young America

Novelty Chain Made from a Match

The accompanying engraving shows what is possible to do with a penknife. A small chain composed of several



Lay a Match on the Picture

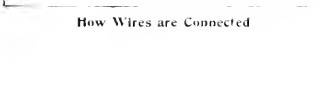
links was cut from the wood that forms the match. Made by A. C. Courath, Marietta, Ohio.

An Interesting Electrical Experiment

Any one possessing a battery having an e. m. f. of from 4 to 20 volts can perform the following experiment, which is particularly interesting on account of the variation of results with apparently the same conditions.

Immerse two pieces of brass in a strong solution of common salt and water. Connect one piece to the positive wire and the other to the negative, taking care that the brass pieces do not touch each other.

After the current has passed one or two minutes, the solution will become colored, and if the process is continued a colored pigment will be precipitated. The color of the precipitant



How Wires are Connected

varies considerably and may be either yellow, blue, orange, green or brown, and possibly others, depending on the strength of the current, the strength of the solution, and the composition of the brass.—Contributed by F. W. D., Chicago.

Restoring Broken Negatives

Whoever has the misfortune to break a valuable negative need not despair, for the damage can be repaired most effectively. In case the negative be broken into many pieces, take a

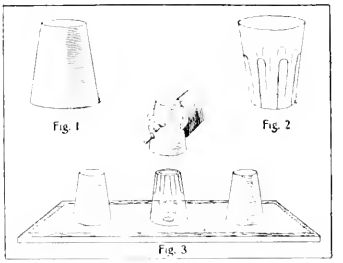
Before and After Mending

clean glass the same size as the broken negative, and put upon this the pieces, joining them accurately, says Camera Craft. Put another clean glass on top of this and bind the three together with passe-partout binding or gummed strips of ordinary paper, as one would a lantern slide, and cover the glass edges. Next make a transparency of this (in the camera, of course), and if done right the positive will only show the cracks as dark and light lines. The

dark lines are removed with the etching knife and the light ones with the retouching pencil. From this transparency another negative can be made, or as many negatives as necessary, by either contact or in the camera, and if the work on the glass positive was done carefully, no trace of the break should be seen on the finished negative. If the negative is broken in two or three larger pieces only, a contact positive may be made in the printing frame without binding, by using a clean glass in the latter, upon which the pieces are put together, face up, and a dry plate exposed in contact with them in the dark room. The accompanying engravings show a print before and after repairing a broken negative in this manner.

Coin and Tumbler Trick

The accompanying sketch shows how a good trick may be easily performed by any one. Lay a piece of



This is a Good Trick

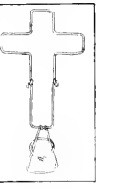
heavy paper that is free from creases on a board or table. Secure three tumblers that are alike and stick a piece of the same heavy paper over the openings in two of them, neatly trimming it all around the edges so as to leave nothing of the paper for any one to see. Make three covers of paper as shown in Fig. 1 to put over the tumblers. Place three coins on the sheet of paper, then the tumblers with covers on top of the coins, the unprepared tumbler being in the middle. Now lift the covers off the end tumblers, and you will see that the paper on the openings covers the coins. Replace the covers, lift the middle one, and a coin will be seen under the tumbler, as the opening of this tumbler is not covered. Drop the cover back again and lift the other tumblers and covers bodily, so that the spectators can see the coins, remarking at the same time that you can make them vanish from one to the other. The openings of the tumblers must never be exposed so that any one can see them, and a safe way to do this is to keep them level with the table.

Another Way to Renew Dry Batteries

There are many methods of renewing dry batteries, and I have used several of them, but I found the following the best: Remove the paper cover and with a ¼-in. drill make about six holes around the side of the zinc, about ½ in. from the bottom. Then drill another row of holes about half way up the side and put the battery to soak in a solution of sal ammoniac for 48 hours. Then remove and plug the holes up with hard soap, and replace in the paper box, when it will give nearly as strong a current as when new.

Simply Made Wire Puzzle

The object of this simply made wire puzzle is to get the ring off, which is not easy unless you know how. To do so it is necessary to move the triangle with ring to one of the hinge joints and fold the puzzle. Then slip the ring off the triangle over the hinge joint and it will slip all around and off at the other hinge.

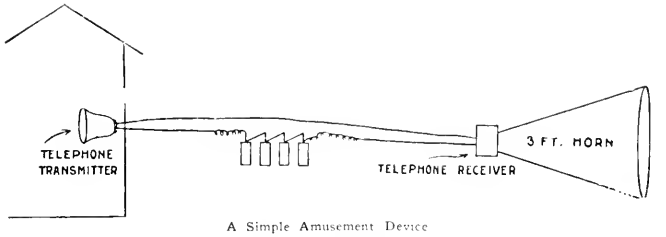


Diabolo is pronounced Dee-ab-lo.

A Mechanical Ventriloquist And How To Make It

An apparatus rigged up as shown in the illustration will afford any amount of amusement to the boy who cares to try it. The materials required are a watch case telephone receiver, a transmitter, a large phonograph horn, about 200 ft. of No. 18 gauge wire and three or four batteries.

Fasten the watch case receiver to the



A Simple Amusement Device

horn, being careful not to let it touch the diaphragm of the receiver. Run the line and attach the transmitter at its opposite end. When one talks into the transmitter a person 200 ft. distant from the receiver can plainly hear what is said. If the receiver and horn end is hidden in a clump of bushes near a road, people passing will be greatly puzzled at hearing a voice, seemingly out of uninhabited space.

How to Build an Electric Engine

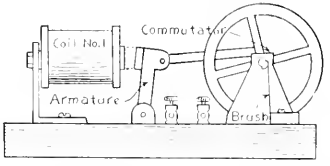
This engine, if carefully made, presents a neat appearance and is capable of running toy machinery on very low current strength—the one I made ran satisfactorily on 1/2 5 amperes.

The coils may be those of an old electric bell, mounted on a light piece of angle-iron, at a height of not more than 1 in. from the baseboard. The fly-wheel standard, crank-rod and armature may be made out of galvanized iron, No. 16 being most suitable. A small valve-wheel makes a very good fly-wheel, but care must be taken in mounting it upon the shaft, for if the shaft is not in the center the engine will not run smoothly.

Make the shaft to extend on each side of the two bearings, so that the commutator may be attached to one side and so the other side may be bent into the form of a crank. On the commutator side place a brush in such position that during every revolution the circuit will be alternately opened and closed. Arrange the commutator so that the circuit will be closed either when the handle is at the top or when it is at the bottom, which makes no difference, except for the direction in which the engine will run.

Let us suppose that the crank is pointed downward. The circuit is now closed by the commutator and the armature is attracted by the electro-magnet, but, as it approaches the magnet, the circuit is broken and the fly-wheel pulls it back again, only to be attracted when the circuit is again closed.

By adjusting the commutator, several different speeds may be obtained, as well as reversing the engine accom-

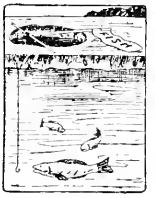


Home-Made Electric Engine

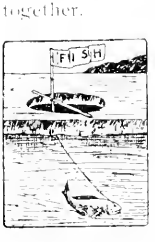
plished, which is done by placing the crank so that it points upward, then twisting the commutator around so that the circuit is closed.—Contributed by Warren B. Weyrick, Akron, O.

Devices of Winter Sports—How to Make and Use Them

In the north the red-cheeked boy digs a hole in the ice and while he amuses and invigorates himself at skating, the fish underneath the icy sheet fasten themselves to the hook he has let down through a hole. The boy used to sit over the hole in the ice and wait for the fish to bite, but that became too slow and detracted too much from his pleasure at skating. So his inventive genius set itself to work and the "tip up" and "signal" shown in the illustration was the result. When the fish is not biting the flag lies flat on the ice, but as soon as a fish has swallowed the hook the flag pole stands straight up waiting its bright colored flag to the breezes and all the boys on the skating pond read the word "fish." The fish is drawn up, the hook rebated and the youthful fisherman resumes his pleasures on the ice. Often a score or more of these "tip ups" are planted about the edges of the ice pond, each boy bringing his fishing tackle with his skates and thus finding a double source of amusement. Maybe one boy will thus have a half dozen different lines in the water at once, it being easy to watch them all together.



"Tip-Up Pole"

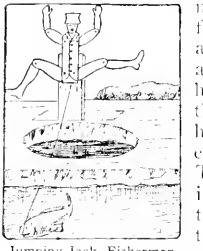


"Tip-Up" Fish Caught

The device by which the fish is made to give its own signal when caught is exceedingly simple and any boy can make it. Procure a light rod about 2 ft. in length and to one end fasten a small flag, made of any bright colored cloth. Bind the rod at right angles to another stick which is placed across the hole, so that a short piece of the flag-rod projects over the cross stick. To this short end fasten the fishing line. Be sure and use strong string in binding the two rods together, and also take care that the cross stick is long enough to permit several inches of each end to rest on the ice. After fastening the line to the short end of the rod, bait the hook with a live minnow or other suitable bait and let it down through the hole. When the fish is hooked the flag will instantly raise and wave about strenuously until the fish is taken from the water.

"Jumping Jack" Fisherman

If the small boy has a "jumping-jack" left over from Christmas he may make this do his fishing for him and serve as well as the "tip up," or he can easily make the jumping-jack himself independent of Santa Claus. The string which is pulled to make the joints move is tied securely to the fishing line; the hook is baited and lowered into the water through a hole in the ice. The "jumping-jack" waves his legs and arms frantically to notify the boys when the fish is biting. The "jumping-jack" is also used for fishing in summer time by placing it on a float which is cast into the water.



Jumping-Jack Fisherman

Winter Velocipede

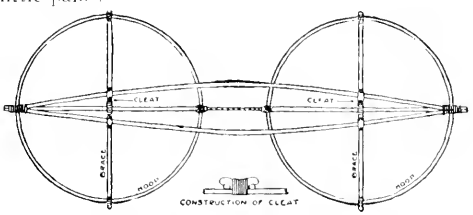
Bicycles may be converted into novel sleighs by simply overhauling. The usual bicycle frame and pedals are used, and gearing transmits to contact wheels, in which are sharp spikes for catching in the snow or ice. Instead of moving on wheels the machine is carried on runners.

The Running Sleigh

Another winter sport, very popular in Sweden, and that has already reached

America, is the "running sleigh," shown in the illustration. A light sleigh is equipped with long double runners and is propelled by foot power. The person using the sleigh stands with one foot upon a rest attached to one of the braces connecting the runners and propels the sleigh by pushing backward with the other foot. To steady the body an upright support is attached to the runners. The contrivance can be used upon hard frozen ground, thin ice and snow-covered surfaces, and under favorable conditions moves with remarkable speed. The "running sleigh" has a decided advantage over skis, because the two foot supports are braced so that they cannot come apart. Any boy can make the sleigh with a little pains.

Running Sleigh



Frame for Skater's Sails

The Winged Skater

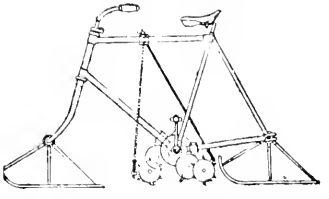
With the actual speed of the wind a skater may be hurled along the ice if he is aided by sails. He has been known to travel at the rate of 40 miles an hour, and the sport while affording the limit of excitement, is not attended with danger. The sails are easily made, as the illustrations and description will show.

Secure two large thin hoops about 4 ft. in diameter. They may be obtained from an old hogshead or by bending thin strips. For each hoop select a piece of strong cane about $^3/_4$ in. in diameter to constitute the fore and main masts or cross-yards. Extend these across the center of the hoop and fasten each end firmly to the hoop's sides. For the middle of each cross-spar make a cleat and lash it on firmly.

The main spar should also be made of two pieces of strong cane, each about $9^1/_2$ ft. long. Bind them together at each end so that the large end of one is fastened to the small end of the other.

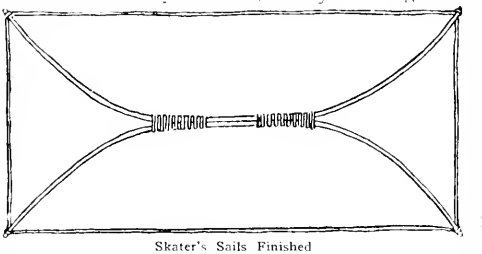
Next comes the attaching of the sails to the separate masts. The sails should be made of strong sheeting or thin canvas. Tack the cloth to the hoop on the inner side after the cloth has been wrapped around the hoop two or three times.

Now the main spar should be attached by springing it apart and slipping the cleats of the cross-spar between the two pieces. Bind the inner sides of the hoops tightly together by means of a very strong double cord, as shown in the figure. Then your sail



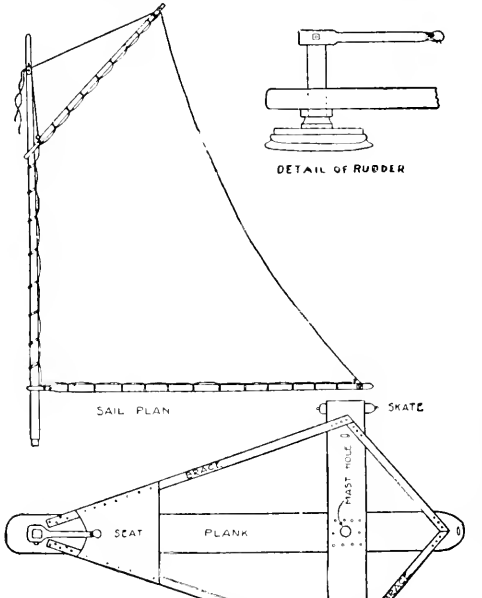
The Bicycle Sleigh

is ready for the ice pond. See that your skates are securely fastened, raise your



Skater's Sails Finished

sail and you will skim along the ice as lightly as a bird on the wing. With a little practice you will learn to tack and guide yourself as desired.



Plan of Ice Boat, Sail and Rudder

If the hoops cannot be easily obtained the sails may be made equally effective by using the main spar and fore and main masts as herein described, making the sails square shaped instead of round and leaving off the hoops. In this case the sails should be securely bound with strong tape. Attach a corner to each end of the cross-spar, and a corner to the outer end of the main spar. The remaining corner of each then appears opposite to each other, and should be fastened together by strong cord in the same manner as the hoops. In this case the sails may be left off until after the frame is entirely put together and then fastened on to the spars by buttons.

A more simple sail may be made according to the plans illustrated in the lower drawing. It is made by binding together in the center the halves of two strong hogshead hoops, or two bent poles are better. If possible the sail should be about 8 ft. long and 4 ft. wide. Fasten on the sail at the four corners. The rig will convey two persons and is more easily constructed than any other.

Ice Boating

But the sport that is greatest of all, the one that used to be part of the life of every northern boy, and which is being revived in popularity after years of stagnation, is ice boating. With the aid of old skates, pieces of board and an old sheet or a small bit of canvas, any boy possessed of ordinary mechanical genius may make an ice boat. The frame of the boat should be made something in the form of a kite. The centerboard should be 4 or 5 ft. long, 6 in. wide and 2 in. thick. The cross board may be of a piece of 1 by 6-in. plank 3 ft.

long. Fasten these with braces of small stout strip, as shown in the drawing, and screw the cross-piece securely to the center-board. Bore a hole in the center of the intersection for the mast pole. The seat may be made of a piece of strong cloth or leather. Three skates are fastened on to either side of the cross-board and one to the rear end of the center-board, the latter of which is to operate as a rudder. In attaching the skates first make a couple of runner blocks, each 6 in. long and 3 in. wide. Bore holes in them for the straps of the skates to pass through and fasten them securely. Nail the runner blocks firmly to the cross-board about 1½ in. from each end.

Boy's Ice Boat

In making the rudder hew down a piece of scantling 1 ft. long until it assumes the shape of a club with a flat base. Nail a strip of wood firmly to this base, and to the strip fasten the skate. Run the top of the club through a hole bored in the stern of the center-board. Then make the helm by boring a hole in one end of a strip of soft board about 1 ft. long, and through this hole pass the club or rubber-pole and fasten it so it may be shifted when desired. Make the sail out of an old sheet, if it be strong enough, piece of canvas, or any such substance and attach it to the mast and sprit as shown in the illustration, and guide it by a stout string attached to the lower outer corner. As

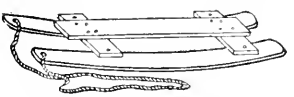


Fig. 1—Barrel Stave Sled

an ice boat will travel faster than the wind, some care and considerable skill is necessary. Unless you are accustomed to managing a sail boat, do not select a place in which to learn where there are air holes or open water. To stop the boat throw the head around into the wind, same as you would with a sail boat. If the wind is strong the occupants of the boat should lie flat on their stomach.

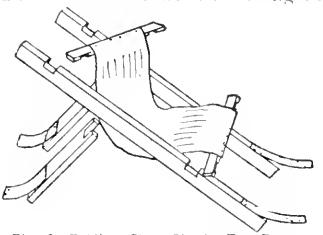
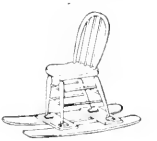


Fig. 3—Folding Chair Sleigh Top Parts Disconnected

Coasters and Chair Sleighs

Make your own sled, boys! There is no use in buying them, because your hand-made sled is probably better than any purchased one and then you can take so much more pride in it when you know it is of your own construction. There are so many different designs of sleds that can be made by hand that the matter can be left almost entirely to your own ingenuity. You can make one like the bought sleds and face the runners with pieces of an iron hoop which will answer every purpose. A



Chair Sleigh

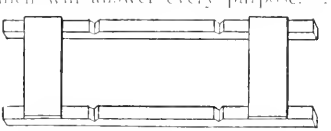


Fig. 2—Folding Chair Sleigh Bottom

good sled for coasting consists simply of two barrel staves and three pieces of board as shown in the picture, Fig. 1. No bought sled will equal it for coasting and it is also just the thing for carrying loads of snow for building snow houses. The method of its construction is so simple that no other description is needed than the picture. You

can make a chair-sleigh out of this by fitting a chair on the cross board instead of the long top board or it will be still stronger if the top board is allowed to remain, and then you will have a device that can readily again be transformed into a coasting sled. In making the chair-sleigh it is necessary, in order to hold the chair in place, to nail four L-shaped blocks on the cross boards, one for each leg of the chair. Skating along over the ice and pushing the chair in front of him the proud possessor of a chair-sleigh may take his mother, grown sister or lady friend with him on his outings, and permit her to ride in the chair.

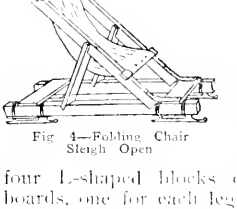


Fig 4—Folding Chair Sleigh Open

Folding Chair Sleigh

A folding chair sleigh is even more enjoyable and convenient than the device just described. If the ice pond is far from home this may be placed under your arm and carried where you like.

The illustrations, Figs. 2 and 3, show all the parts as they should look before being joined together. The seat may be made of a piece of canvas or carpet. The hinges are of leather. Figure 4 shows the folding chair sleigh after it has been put together. Skates are employed for the runners. The skates may be strapped on or taken off whenever desired. When the chair is lifted the supports slip from the notches on the side bars and fall on the runner bars. The chair is then folded up so that it can be carried by a small boy. With regular metal hinges and light timbers a very handsome chair can be constructed that will also afford an ornamental lawn chair for summer.

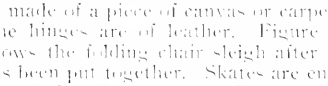


Fig. 5—Folding Chair Sleigh Closed

The Toboggan Sled

When the snow is very deep a toboggan sled is the thing for real sport. The runners of the ordinary sled break through the crust of the deep snow, blocking the progress, and spoiling the fun. The toboggan sled, with its broad, smooth bottom, glides along over the soft surface with perfect ease.

To make the toboggan sled, secure two boards each 10 ft. long and 1 ft. wide and so thin that they can be easily bent. Place the boards beside each other and join them together with cross sticks. Screw the boards to the cross stick from the bottom and be sure that the heads of the screws are buried deep enough in the wood to not protrude, so that the bottom will present an absolutely smooth surface to the snow. Fasten two side bars to the top of the cross sticks and screw them firmly. In some instances the timbers are fastened together by strings, a groove being cut in the bottom of the boards so as to keep the strings from protruding and being ground to pieces. After the side bars are securely fastened, bend the ends of the boards over and tie them to the ends of the front cross bar to hold them in position. See Fig. 6. The strings for keeping the boards bent must be very strong. Pieces of stout wire, or a slender steel rod, are even better. The toboggan slide is the favored device of sport among the boys in Canada, where nearly every boy knows how to make them.

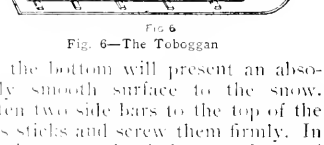


Fig 6

Fig. 6—The Toboggan

The Norwegian Ski.

You have often read of the ski, the snowshoe used by the Norwegians and other people living in the far north. With them the men and women glide down the snow-covered mountain sides, leap across ditches, run races and have all kinds of sport. They are just

as amusing to the American boy who has ever learned to manipulate them, and it is wonderful how much skill can be attained in their use. Any boy with a little mechanical ingenuity can make a pair of skis (pronounced skees). They can be made from two barrel staves. Select staves of straight grained wood. Sharpen the ends of each and score each end by cutting grooves in the wood, as shown in the cut, Fig. 1. A pocket knife or small gouge will suffice for this work. Then smear the end of the staves with oil and hold them close to a hot fire until they can be bent so as to tip the toes upward, as shown in the picture, Fig. 2. Then with a cord bind the staves as they are bent and permit them to remain thus tied until they retain the curved form of their own accord. Now screw on top of each ski a little block, just broad and high enough to fit in front of the heels of your shoe. Fasten a strap in front of

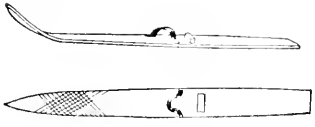
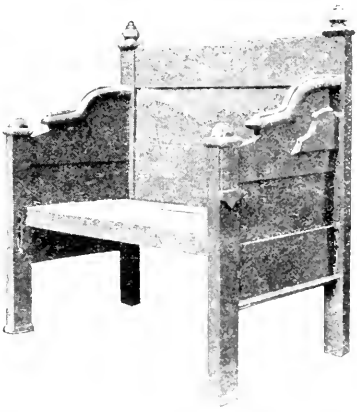


FIG 7
Home-Made Skis

each block through which to slip your toes, and the skis are made. The inside of the shoe heel should press firmly against the block and the toe be held tightly under the strap. This will keep the skis on your feet. Now procure a stick with which to steer and hunt a snow bank. At first you will afford more amusement to onlookers than to yourself, for the skis have a way of trying to run in opposite directions, crosswise and various ways, but with practice you will soon become expert in their manipulation.

Home-Made Settee

Many people have old wooden beds stored away which can easily be made into handy settees like the one shown in the accompanying photograph. A few nails and one-half dozen 3-in. screws are all the materials necessary besides the old bed. The tools needed are a saw, hammer and a screwdriver. The head-board, if too high, can be cut



Settee Made from Old Wooden Bed

off and some of the ornaments replaced. The footboard must be cut in two to make the ends or arms of the settee. The side rails and a few of the slats are used in making the seat.- Contributed by Wm. F. Hild, Lake Forest, Ill.

Enameling a Bicycle Frame

Make an enamel by mixing 2 oz. burnt umber with 1 qt. boiled oil, heating, and then adding 1 oz. asphaltum. Keep the mass hot until thoroughly mixed, says the Master Painter. Thin with turpentine while still hot.

Use a camel's hair brush for applying the enamel and allow it to set; then place the article in an oven, bake for six or eight hours at a temperature of 250 deg. F. When cool rub down with steel wool. Apply a finishing coat and allow it to bake eight hours at 250 deg. F. Rub down with a soft rag, varnish and bake again at 200 deg. F. Heat and cool the frame gradually each time. Black enamel is easiest to apply and bakes hardest, but requires a temperature of 300 deg. Colors can be baked at from 200 to 250 deg.

How to Make a Sewing Bag

A very practical and novel sewing bag for odds and ends necessary for mending, etc., can be made of a folding camp stool. If an old stool is not

Fig. 1 Fig. 2

Camp-Stool Work Bag

at hand, a new one can be purchased for 25 cents. Remove the top or seat, which is usually made of a piece of carpet, then make a bag as shown in Fig. 1 and stitch a heavy cord around the top to make it strong. Make pockets on the inside as shown and nail the bag to the two crosspieces on which the ends of the carpet were tacked. Large, brass furniture nails should be used. Attach a small hook and eye on each end and fasten two leather handles to the crosspieces.

Such a bag requires little room when folded and can be stored in a closet when not in use. Contributed by Joseph Ledwinka, Philadelphia, Pa.

Home-Made Roller Skates

The rubber-tired wheels of an old carpet sweeper can be used to advantage in making a pair of roller skates. In Fig. 1 is shown how an iron washer or two may be fastened to the wood with a piece of sheet metal to support

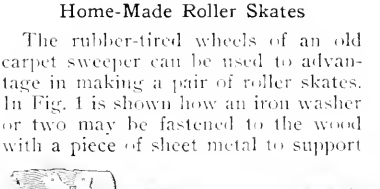


Fig. 1 Fig. 2

Rubber Tired Roller Skate

the short axles of the wheels. The wheels are oiled through the holes A and B, Fig. 2. These holes should be smaller than the axles. The two side pieces are fastened together with a board nailed on the top edges, as shown. This board also furnishes the flat top for the shoe sole. Two straps are attached for fastening the skate to the shoe.—Contributed by Thos. De Loof, Grand Rapids, Mich.

Adjuster for Flexible Electric Wires

The accompanying illustration shows an adjuster for changing the drop of an electric light. The main feature of this adjuster is that it can be removed from the cord at any time. The adjuster is made from a piece of wood, ⅜ in. thick, 2 in. wide and 3 in. long. A ¼-in. hole is bored in the center near each end of the wood and a slot cut from

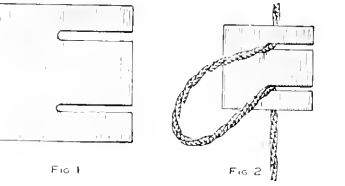


Fig. 1 Fig. 2

Can Be Taken from the Cord

the holes to the outside edge, as shown in Fig. 1. It is attached to the flexible cord as shown in Fig. 2.—Contributed by J. J. Voelcker, Decatur, Ill.

Making Photographs on Watch Dials

Beat to a foam the white of an egg, with the addition of a little ammonia. Add 9 oz. and 3 dr. of water and beat again. After the egg has settled, filter and let the liquid run over the dial, which has been previously cleaned with ammonia. When the surplus has run off, coat with the mixture and allow to dry.

A sensitive collodion is now produced as follows: Dissolve 9 gr. of chloride of zinc in 5 dr. of alcohol; add 7½ gr. of collodion cotton and 6½ dr. of ether. Shake the whole forcibly.

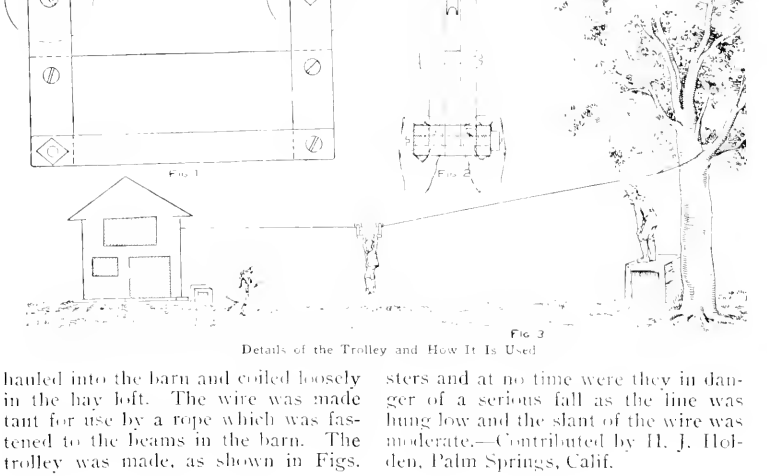
Dissolve 23 gr. of nitrate of silver in hot water, add 1½ dr. of alcohol and keep the whole solution by heating. The silver solution is now added in small quantities at a time to the collodion, which must be well settled. This, of course, is done in the dark room. After 24 hours the emulsion is filtered by passing it through cotton moistened with alcohol. This durable collodion emulsion is now flowed thinly upon the prepared watch dial, which, after the collodion has coagulated, is moved up and down in distilled water until the fatty stripes disappear. The water is then changed once, and after a short immersion, the dial is left to dry on a piece of blotting paper. It is now ready for exposure. Expose under magnesium light and develop with a citrate oxalic developer, or in the following hydroquinone developer:

Hydroquinone	1 dr.
Bromide of potassium	6 dr.
Sulphite of soda	1½ oz.
Carbonate of soda	2 2/3 dr.
Water	11 oz.

After fixing and drying, coat with a transparent positive varnish.

Home-Made Overhead Trolley Coaster

The accompanying sketch shows a playground trolley line which furnished a great deal of amusement to many children at a minimum cost. The wire, which is 3/16 in. in diameter, was stretched between a tree and a barn across a vacant quarter block. The strength of the wire was first tested by a heavy man. When not in use the wire is unhooked from the tree and hauled into the barn and coiled loosely in the hay loft. The wire was made taut for use by a rope which was fastened to the beams in the barn. The trolley was made, as shown in Figs. 1 and 2, of strips of wood bolted with stove bolts on two grooved pulleys. The middle wide board was made of hardwood. The wheels were taken from light pulley blocks and stove bolts were purchased from a local hardware store to accurately fit the hubs. As it was necessary to keep the bearings greased, we used vaseline. This coaster made great sport for the youngsters and at no time were they in danger of a serious fall as the line was hung low and the slant of the wire was moderate.—Contributed by H. J. Holden, Palm Springs, Calif.



Details of the Trolley and How It Is Used

How to Make an Electric Furnace Regulator

We have a furnace in our house and a part of my work each evening last winter was to go down in the basement at 9 o'clock, fill the furnace with coal for the night and stay there until it was burning in good shape, then to close the draft door. As this performance requires from twenty to thirty minutes I concluded to make a self-acting device which would close the draft and leave the furnace safe, without any further attention on my part, after putting in the coal and opening it up to burn. As some other boys may like to build the same regulator I will tell just how to make one and how it operates.

Referring to Fig. 1, you will see a straight cord is attached to the draft door of the furnace, D, and is run over the pulley P and finally is attached to a small piece of iron, H. This piece of iron is hinged to I. To the other side of H another cord G is fastened, which passes over the pulley N and terminates in any convenient place in the rooms above. This piece of iron H is held in place by the release A. Now C is a coil of wire from a door bell. R is an armature which works A on pivot

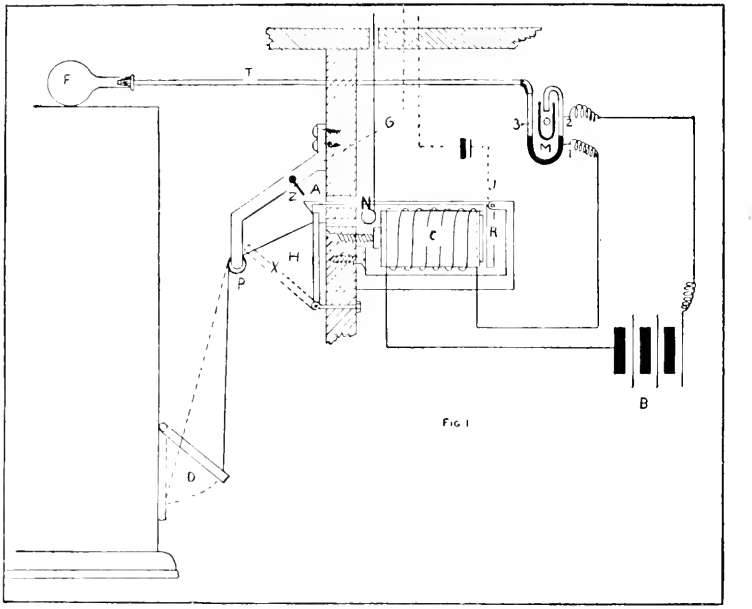


FIG. 1

Details of Furnace Regulator Construction

J. M is a U-tube, filled with mercury, one end being connected to a half liter glass flask F by the tube T, and the other end terminates in an overflow tube O. B is a battery of three bichromate cells which are connected up with the C and the platinum points 1—2, which are fused into the U-tube.

On fixing the furnace the iron piece H takes position X, this being the normal position when draft door D is closed. On arriving upstairs I pull the cord G, which causes the piece H to become fixed in the vertical position

by means of A. This opens the draft door at the same time. Now when the furnace heats up sufficiently it causes the air to expand in F, which causes the mercury in M to rise a little above the point 2. This immediately causes a current to flow through C which in turn draws R towards it, raises A and causes H to drop to position X. This shuts the furnace door. Now the furnace, of course, cools down, thus causing the air in F to contract and consequently opening the circuit through C. If at any time the furnace should overheat, the raising of A, on which is grounded a wire from a signal bell upstairs, will make a circuit through the bell by means of the point Z and wire leading therefrom. This bell also serves to tell me whether H has dropped or not. This same device of regulating the draft D can be used to regulate the damper, found on the coal doors of most furnaces, by simply fusing a platinum point on the other side of M and changing the cord which is attached to D. A two-contact switch could also be inserted to throw connections from 2 to 3. It would work in this manner: The damper door, of course, which keeps a low fire, would be up in a position similar to D; on the furnace cooling too much, connection, due to contracting of air in F, would be made through 3 and C, causing H to drop, thus closing door. This simple device worked very well all last winter and gave me no trouble whatever.

If you cannot readily procure a U-tube, you can make one, as I did, and the work is interesting.

The U-tube is constructed in the following manner. A glass tube is closed at one end. This is done by holding the tube in one corner of a gas flame, somewhat near the dark area (A, Fig. 2), and constantly turning the tube when it will be found that the glass has melted together. Now, after it is cool, about 3 or 4 in. from the sealed end, the tube is held steadily so that the flame will heat one small portion (B, Fig. 2). After this small portion is heated blow into the tube, not very hard, but just enough to cause tube to bulge out. Allow to cool. Then reheat the small bulged portion, blow quite hard, so that the glass will be blown out at this point, forming a small hole. Now insert about $\frac{1}{2}$ in. of platinum wire and reheat, holding platinum

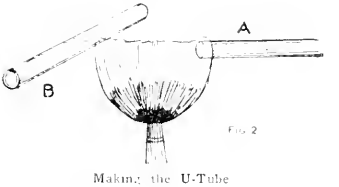


Fig. 2

Making the U-Tube

wire by means of a small pliers so that it will be partly in the tube and partly without. The platinum will stick to the glass, and if glass is sufficiently heated one will be able to pull it, by means of pliers, from one side of the hole to the other, thus sealing the wire into the tube. Another wire is sealed in the same way about 1 in. from the first. Now, to bend the tube, one must hold it, with both hands, in the flame and turn constantly until soft. Quickly withdraw from flame and bend, just as you would a piece of copper wire. Allow to cool slowly.

The several tubes are connected with a short piece of rubber tubing.

The total cost of materials for constructing the apparatus complete will not amount to more than one dollar.—Contributed by M. G. Kopf, Lewis Institute, Chicago.

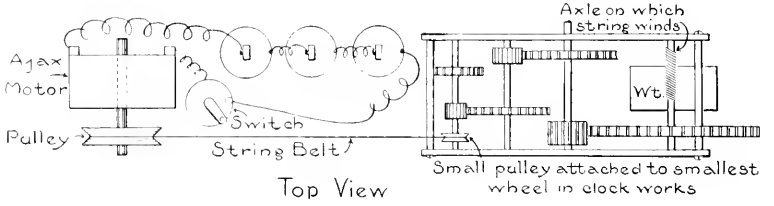
Weatherproofing for Tents

Dissolve 1 oz. sulphate of zinc in 10 gal. water; add $\frac{1}{2}$ lb. sal-soda; stir well until dissolved, and add $\frac{1}{2}$ oz. tartaric acid. Put the tent cover in this solution and let lie 24 hrs. Take out (do not wring it) and hang up to dry.—Grimnell's Hand Book on Painting.

Sheet metal placed between two boards in the jaws of a vise and clamped tightly, can be sawed easily with a hacksaw.

How to Make a Toy Battery Motor Lift A 10-lb. Weight

The materials necessary are a small battery motor, three or four cells of batteries, an old clockwork, and a board



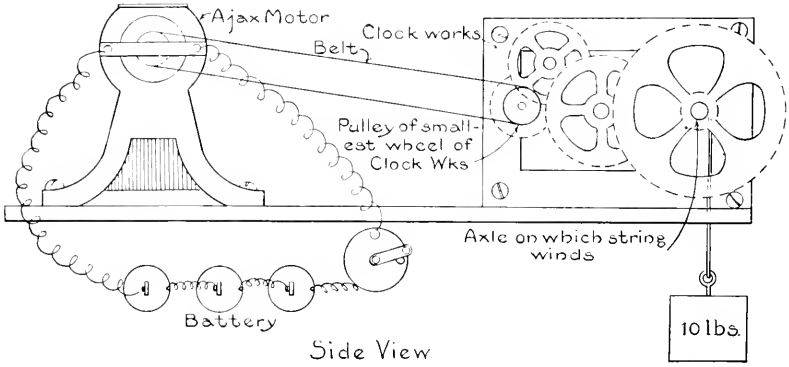
6 in. wide and 12 in. long. Remove the mainspring from the clockwork and make a small pulley and fasten it on the axle of the smallest wheel in the mechanism.

Fasten the clockwork on one end of the board in such position that the large wheel will project over the edge. Place the motor on the board about 6 in. from the clockwork and connect the pulley of the motor with the pulley in the clockwork by a string belt. Now fasten a piece of strong cord or chalk-line to the axle of the large wheel of the clockwork and put a weight of about 10 or 12 lb. on the end of the string.

Using three or four batteries, the motor will lift the weight up to the level of the clockwork without difficulty. This experiment demonstrates the power of gearing.—Contributed by W. J. Slattery, Emsworth, Pa.

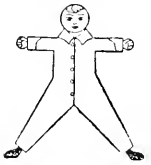
How to Remove Glass Stoppers from Bottles

Glass stoppers which are stuck in bottles may be quickly removed by holding the bottle at a slant of about 45 deg. and applying a burning match to the neck of the bottle around where the stopper seems the tightest and turning the bottle while the match is burning so the glass will be heated evenly all around. This will cause the neck of the bottle to expand before the stopper does and when the flame has well burned out, drop the match and quickly give the stopper a little twist and it will come out readily.—Contributed by Jno. E. Cox, Halstead, Kan.

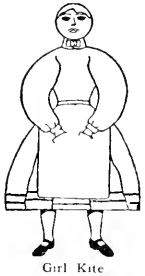


Kites of Many Kinds and How to Make Them

One of the prettiest of all is the butterfly kite. To make this get two thin kite sticks of equal length. Bend each in an arc, tying one end of a strong string to one end of each stick and the other end of the string to a point about 3 in. from the other end of the stick. This leaves one end of each stick free, hooking over the hemisphere described by the thread and the stick. Now tie another thread to each of these free ends and tie the other end of the thread to a point near the other end of the stick, corresponding with the distance from the end at which the first strings were tied on the opposite side. This done, you should have two arched frames, each an exact counterpart of the other in size, curvature and weight. Now fasten the two frames together so that the arcs will overlap each other as shown in the sketch. Bind the intersecting points securely with thread. To make the butterfly's head, secure two heavy broom straws or two short wires, and attach them to the top part of the wing frames near where the sticks intersect, so that the straws or wires will cross. These form the antennae, or the "smellers." Then select the color of paper you want, yellow, brown, blue, white or any other color; lay it on a flat surface and place the frame on top of it, holding the frame down securely with a weight. Then with a pair of scissors cut the paper around the frame, leaving about a $\frac{1}{8}$-in. margin for pasting. Cut slits in the paper about 2 in. apart around the curves and at all angles to keep the paper from wrinkling when it is pasted.

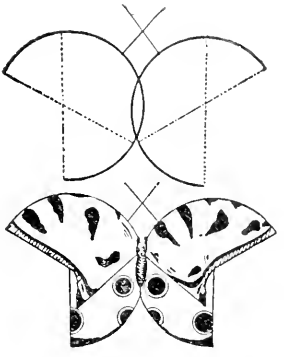


Boy Kite

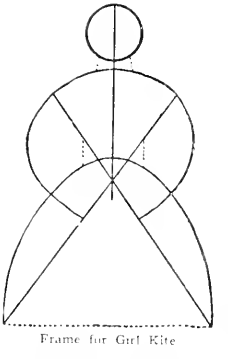


Girl Kite

Distribute the paste with a small brush and make the overlaps a little more than $\frac{1}{4}$ in. wide and press them together with a soft cloth. When the kite is dry decorate it with paint or strips of colored paper in any design you may fancy. The best effects are produced by pasting pieces of colored paper on top of the other paper. Black paper decorations show up to fine advantage when the kite is in flight. Attach the "belly-band" to the curved sticks by punching a hole in the paper in the same manner as it is attached to the common hexagonal or coffin-shaped kite. With a tail, your kite is ready to fly.



Butterfly Kite

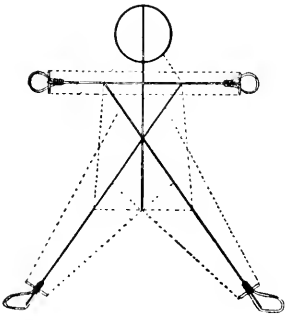


Frame for Girl Kite

Another interesting design is the boy kite. With light colored coat and vest and gay striped trousers, the kite standing high in the air always attracts at-

tention and affords splendid sport for the American youth in springtime.

In making a boy kite it should be remembered that the larger the boy is the better he will fly. To construct the frame, two straight sticks, say 3½ ft. long, should serve for the legs and



Frame for Boy Kite

body; another straight stick forms the spine and should be about 2 ft. 4 in. long. For the arms, get a fourth straight stick about 3 ft. 3 in. long. Make the frame for the head by bending a light tough stick in a circle about 7 in. in diameter. Bind it tightly with a strong thread and through its center run the spine. Then tack on the arm stick 3 in. under the circle so that the spinal column crosses the arm stick exactly in the center. Wrap tightly with strong thread and tack on the two sticks that are to serve for the legs and body. The leg sticks should be fastened to the arm stick about 6 in. on either side of the spinal column, and crossed so that the other ends are 3 ft. apart. Tack them and the arm stick together at the point where they intersect. Small hoops and cross stick of the same material as the head frame should be fastened to both extremities of the arm stick and the lower ends of the leg stick for the hands and feet. See that both hand frames are exactly alike and exercise equal caution regarding the foot frames; also see that the arm stick is at exact right angles with the spine stick and that the kite joints are all firmly tied and the kite evenly balanced; otherwise it may be lopsided. Fasten on the strings of the frame, beginning at the neck at equal distances from the spine, as indicated by the dotted lines in the diagram. Extend a string slantingly from the armstick to the head on both sides of the spinal column, and run all the other strings as shown in the cut, being careful that both sides of the frame correspond in measurements.

To cover the kite, select different colors of paper to suit your taste, and after pasting them together, lay the paper on the floor and placing the frame on it, cut out the pattern. Leave an edge of ½ in. all around and make a slit in this edge every 6 in. and at each angle; make the slits 2 in. apart around the head. After the kite is pasted and dry, paint the buttons, hair, eyes, hands, feet, etc., as you desire. Arrange the "belly band" and tail band and attach the kite string in the same manner as in the ordinary coffin-shaped kite.

The "lady kite" is made on the same principle as the boy kite. The frame may be made exactly as the boy kite and then "dressed" with tissue paper to represent a girl, or it may be made on the special frame, page 81. Remember the dotted lines represent the strings or thread, and the other lines indicate the kite sticks. Be careful with your measurements so that each side of the kite corresponds exactly and is well balanced. Also see that every point where the sticks intersect is firmly tacked and bound.

To cover the kite, first paste together pieces of tissue paper of different color to suit your taste. The paste should be made of flour and water and boiled. Make the seams or overlaps not quite ⅜ in. wide. Lay the paper on the floor, using weights to hold it down, and place the frame of the kite upon it. Then cut out the paper around the frame, leaving an edge of ½ in. Don't forget to make a slit in the edge every 6 or 7 in. and at each angle. Around the head the slits are cut 2 in. apart, as in the case of the boy kite. After the kite is

dry, paint the paper as your fancy dictates.

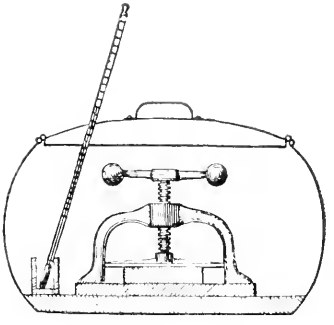
To make the breast band, punch holes through the paper, one upon each side of the leg sticks, just above the bottom, and one upon each side of the arm sticks at the shoulder. Run one end of the string through the hole at the bottom of the left limb and tie it to the leg stick; tie the other end at the right shoulder. Fasten one end of another string of the same length at the bottom of the right leg; pass the string up across the first band and tie the other end at the left shoulder. Attach the kite string to the breast band at the point where the two strings intersect. Tie the knot so that you can slide the kite string up or down until it is properly adjusted. The tail band is made by tying a string to the leg sticks at the bottom of the breast band. Let the string hang slack below the skirt and attach the tail to the center. The same general rules apply in attaching the string and tail to the boy kite.

You can make the lady look as if dancing and kicking in the clouds by making the feet of stiff pasteboard and allowing them to hang loose from the line which forms the bottom of the skirt. The feet will move and sway with each motion of the kite.

How to Make Rubber Stamps

India rubber, especially prepared for stamp-making, should be procured from a dealer or manufacturer, if good results are to be obtained. As an experiment, it is possible for an amateur to prepare the rubber, but, in such cases, it is always attended with uncertain results. The mixed uncured rubber comes in white sheets, strong, firm and about $\frac{1}{8}$ in. thick, and for its manipulation a press is indispensable, but can be home-made.

For the base of the press use a piece of iron, having two holes drilled in it at the middle of opposite sides, through which pass bolts, letting the thread ends extend upward and counter-sinking places for the bolt heads to keep the under side of the base level. Solder the bolts in place at the base. The upper part of the press, or the platen, is also of iron, cut so it can be swung

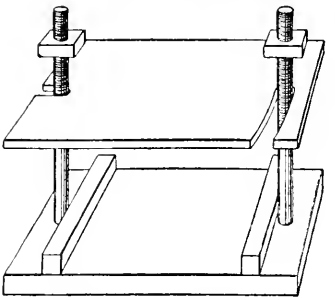


Fish Kettle Vulcanizer

off the bolts, rather than by removing the nuts and lifting it off. String a half dozen nuts, larger than those which screw on, on each bolt, so that when the upper nut on each is screwed to the extent of the thread the pressure will be communicated through the nuts wedged in between the platen and the upper nut. The bolt holes in the platen should be directly over those in the base. Distance pieces of an exact thickness should be provided for use on the base; these serve to keep the pressure even.

In preparing the mould, if type is to be copied, use rather large type with wide spaces and set up with high quads and spaces, or the type faces may be filled up by rubbing with either wax, or soap, lightly brushing off any that remains loose. The type so set should be locked into a frame. This may be made of two pieces of wood bolted together at both ends, or of printer's furniture. Place it on a flat surface (marble is good, but any perfectly smooth surface will do) and place distance pieces $\frac{1}{8}$ in. higher than its upper surface on either side of it. Apply olive oil to the type faces and wipe off any excess. To form the matrix or reverse of the model, take a piece of iron larger than the inscription to be copied, and spread upon it to a depth of $\frac{1}{4}$ in. a putty made by mixing plaster of paris

and water to the right consistency. By means of a table knife spread the plaster smoothly and then invert the plate upon the model and press down until



Vulcanizing Press for Rubber Stamps

the distance pieces are struck. Let it set 10 minutes and then remove. If care has been taken the matrix will be perfect. After it has thoroughly dried, preferably in an oven, saturate it with an alcoholic solution of shellac to strengthen it.

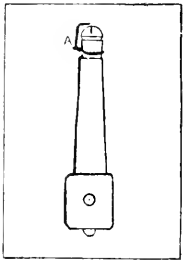
Cut a piece of smooth rubber, large enough to cover the matrix, from the sheet, throw this into a box of talc, or powdered soapstone, so that it receives a coating on both sides; dust a little of the powder over the matrix, also. Place the press on a support over a gas burner, or a kerosene lamp, and apply the heat. Place the matrix on the base of the press, dust off the piece of india rubber and place in the press upon the matrix and screw down the platen. Heat the press to 284 deg. F. and keep screwing down the platen so that the rubber, now soft and putty-like, is forced into every recess of the matrix. A thermometer is not necessary; some rubber always protrudes and the stage of the process can be told from that. At first it is quite elastic, then as the heat increases it becomes soft, then the curing begins and it again becomes elastic, so that, if a point of a knife blade is pressed against it, it resumes its shape when the point is removed. When this takes place it is then thoroughly vulcanized and the sheet can be removed from the matrix. Ten minutes, under favorable conditions, is sufficient time for moulding the rubber. By means of common glue, or bicycle tire cement, fasten the rubber stamp to a wooden handle.

It is possible to dispense with the press in making stamps, where the work is not done in quantities, and use a hot flat-iron. The matrix is placed on a stove at low heat, the rubber laid on and the hot iron applied. But a few moments are required to mould it.

An old letter press if it be inclosed in a tin oven makes a good press, or all the necessary materials and apparatus can be purchased from a dealer. Any type such as all printers use will answer.

To Light a Gaslight Without Matches

It is probably well known that if you rub your feet briskly over a carpet on a dry, cold day and then touch any metallic object with your finger it will emit a small spark. The following amusing experiment may be done on the same principle:



Take any small piece of wire about 2 in. long and twist it around a gas-burner as shown at A in the sketch. Have the tip of the burner about $\frac{1}{8}$ in. below the end of the wire. The wire must be just far enough away from the center of the burner to keep it out of the flame, or else it will melt.

Now get a friend to turn on the gas when you are ready for it. Go around the room once or twice rubbing your feet along the carpet. When you come around to the gaslight touch the point of the wire and if the gas is turned on, the light will flare right up as if it had been lit with a match.

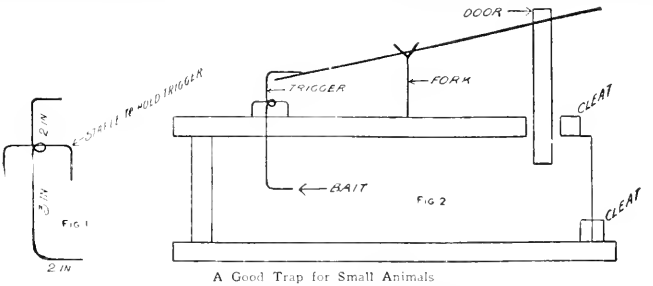
This experiment cannot be done on a damp day or without shoes, and works best in cold weather.—Contributed by E. H. Klipstein.

How To Make a Trap For Rabbits, Rats and Mice

From an old 6-in. pine fence board cut off four pieces 2½ ft. long and one 6 in. square for the end of the trap and another 4 in. by 8 in. for the door. Use old boards, as new boards scare rabbits.

Figure 1 shows how the box is made. It should be 4 in. wide and 6 in. high on the inside. The top and bottom boards project 1 in. beyond the side boards at the back and the end board is set in. The top board should be 2 in. shorter than the sides at the front. Nail a strip on the top board back of the door and one on the bottom board so the game cannot push the door open from inside the trap and get out.

In the middle of the top board bore a hole and put a crotched stick in for the lever to rest on. Bore another hole in the top of the door for the lever to pass through. Two inches from the back of the box bore a hole for the trigger, which should be made out of heavy wire in the manner shown in Fig. 2. The door of the trap must work easily and loosely.



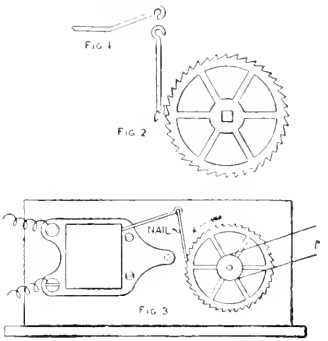
A Good Trap for Small Animals

Novel Electric Motor

The materials necessary to make this motor are an old electric bell of the "buzzer" type and a cogwheel from an old clock.

Remove the hammer-head and gong from the bell, then bend the end of the hammer into a loop, as in Fig. 1. Now make a little wire catch like Fig. 2, and fasten its loop into the loop of the hammer. Mount the bell on a small board as in Fig. 3 and fasten the cogwheel almost on a line with it. Now press down the hammer and place a nail in the position shown in the diagram so that the catch touches one of the teeth.

Fasten the board in an upright position and attach two dry batteries to the binding-posts. If properly connected, the fly-wheel will turn quite rapidly and with amazing force for so small a machine. The machine, however, has a fixed direction as shown by the arrow, but the belting can be arranged so as to send the models in a reversed direction if required. The materials for the motor should not cost more than 25c for the bell and if you have an old bell it will cost next to nothing. Contributed by Fred C. Curry, Brockville, Ontario.



Novel Electric Motor

How to Build a Model Yacht

Alex. E. Quinn of San Francisco.

Within the past few years the interesting and instructive sport of model yachting has become very popular in the sporting circles of San Francisco. This popularity has been caused principally by the efforts of a lately formed model yacht club, in the affairs of which some of the foremost citizens of San Francisco have taken a great interest. Quite a few of these men are naval architects, marine engineers, etc.

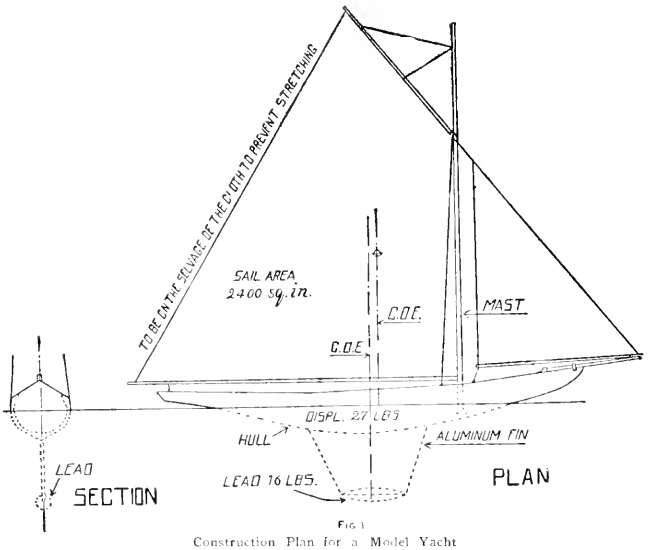


FIG. 1
Construction Plan for a Model Yacht

The yachts permitted to enter these races must not be over 50 in. on the load waterline, with a corresponding sail area of generally not more than 2,500 sq. in., being classified according to size, etc., in three classes.

The following will give an outline of how to construct one of these yachts. The first step is to build the hull, the best wood for this being cedar, and the best metal aluminum, the cedar boat (which will be described) is cheaper, but takes a longer time to build, as the wood has to be thoroughly seasoned, then shaped exactly on the outside to template taken from the lines of the plan; after which the inside must be hollowed out until the shell is about $\frac{3}{8}$-in. thick, except along the keel, where it is advisable to leave $\frac{1}{2}$ in. of wood for fastening the aluminum fin which takes the lead, and along the deck line where it is best to leave $\frac{1}{4}$ in. thickness for fastening the deck to the hull. In order to make the hull perfectly watertight, it is best to first give it three coats of shellac on the inside, then to glue strips of light canvas or linen upon this and then give two or more coats overall. For a boat of 50-in. overall, 50-in. on the load waterline and a beam of 10 in., the hull must not weigh more than 7 lb. after the aluminum fin, Fig. 1, is fitted; the boat complete must not weigh more than 27 lb.

For ease in transportation the mast should be made portable, at the same time, however, the opening in the deck for the mast must be watertight, and

this result is best obtained by placing a piece of $\frac{7}{8}$-in. brass tubing over a plug secured to the keel by a wood screw (See Fig. 2). This tube is made long enough to project through the deck. To prevent turning, a pin is put through tube and plug. The mast may then be put in place or removed very easily. An aluminum flanged plate bedded in white lead is placed on the deck where the tube comes through in order to make it watertight.

The bow-sprit, (Fig. 1) is best made portable also, and the most suitable wood for this part is oak. The bow-sprit can be fitted to the deck of the boat by means of two brackets, the one at the end of the bow-sprit made with three legs, the other bracket need only be a common strap bracket. The material most suitable for these brackets is aluminum, as this metal is lightest and is not affected by water.

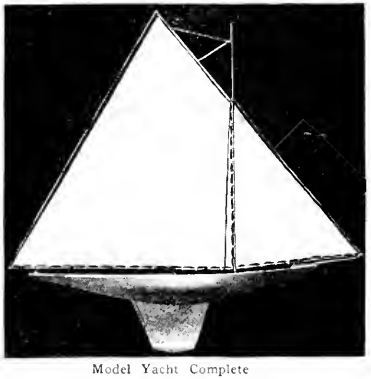
All the rigging fittings, such as rings, screw eyes, pins, etc., had best be made of aluminum also. Two aluminum travelers one for the gib and one for the mainsail, must be fitted to the deck, so as to give the booms enough play. Both should be the same length, so the mainsail and gib will be on the same angle. This angle depends on the strength of the wind and can be found by experience in sailing boom stays to be fitted, so that they can be adjusted accordingly.

The best material for the sails is Lonsdale cambric. If care is taken to have the edge of the sail running from the gaff to the end of the boom, in the selvage, no trouble will be experienced on account of slack or baggy sails.

FIG. 2
Construction of Portable Mast

The center of effort of the entire sail area must be about 2 in. or more forward of the center of buoyancy of the hull, because these model yachts are fitted without rudders and this is necessary for them to sail straight.

The lead for the size of boat mentioned is best cast in cigar shape and



Model Yacht Complete

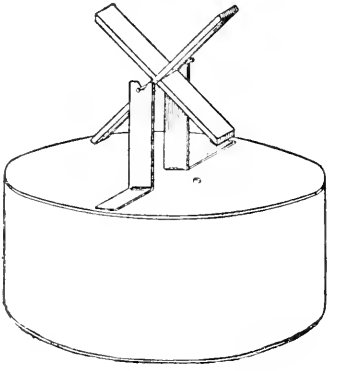
must have its center of buoyancy directly under the center of buoyancy of the hull, because if these two are not in correct relation with each other, the waterline of the boat will change, making the hull dip either forward or aft.

The aluminum fin on which the lead is fastened is best attached to the hull of the boat (if boat is finished natural wood) by means of two aluminum angles $\frac{3}{4}$ in. by $\frac{3}{4}$ in., or if the boat is to be painted or enameled, by cutting slots 1 in. deep and 1 in. apart, or as wide apart as will come out even, in the upper edge of the fin and then bending the squares alternately to right and left. The hull can then be recessed in way of these squares, in each of which three wood screws fastening it to the hull had best be put; in this way a very smooth job can be done. The lead may be fastened to the aluminum fin by slotting it lengthwise about half the diameter deep, then boring two or more holes through lead and fin, and fastening the lead to the fin.

The claw of a hammer can be used for removing the insulation on copper wire, if not more than 1 in. is taken off at a time.

How to Make a Very Simple Steam Turbine

A tin can of quart size or larger may serve for the boiler. The can must have a good lid, so that it will not leak. In the top of the can, near one edge, punch a small hole. Through this hole the steam is to come out and strike the paddles of a small wheel. Make the wheel of two pieces of wood, fastened together by cutting halfway through the middle of each and then fitting each into the other, as every boy knows how to do to form a four-paddle water wheel. Drive a pin in each side to



A Simple Turbine Engine

serve as a shaft. For the supports of the wheel use pieces of tin, bent into L-shape and soldered fast to the can. Place them in such position, with respect to the small hole punched, that the spurt of steam from the hole will strike the ends of the paddles of the wheel squarely. Fill the boiler three-fourths full of water, set it on a hot stove and as soon as steam is generated fast enough to come out the escape hole with slight force the wheel will start to revolve.

How to Make Paper Balloons

Any boy who can make kites can make enough paper balloons for a Fourth of July celebration and can make and sell enough of them to pay for all the necessary materials, which are very few.

Paper balloons may be of any size desired and have as many gores as one wishes in whatever colors one prefers. A very good size is 3 ft. in height with 32 gores, each gore being 3 in. wide at the bottom, 8 in. wide at its widest point, and 1 in. wide at the top. To make the balloon pear-shaped, the three widths mentioned when added together (3+8+1=12) should be one-third of the height of the balloon.

Procure close-textured tissue paper in any contrasting colors you like; red and white are good. Cut out a pasteboard pattern exactly the shape and size the gores are to be and cut the gores out by it.

Varnish each gore with boiled oil and hang it up on a line to dry, being careful not to let it come in contact with any other gore. When they are perfectly dry put them together by means of gum water, or clear thin paste. To do this gum about ½ in. of a gore and lay one edge of another gore midway across the gummed space and dab down very lightly by means of a clean cloth. In this manner unite all the gores in pairs until there are but 16 parts. Continue to unite them until you have two halves. Join these very carefully, closing the balloon at the top completely. Each time you paste a gore hang the part up until perfectly dry before using it further.

In the bottom of the balloon work a circle of wire 6 in. in diameter and fasten a wire with a piece of sponge strung on it across the circle of wire.

When using dry cells in a damp place put them in a tight box and pour melted paraffine around them.

A little graphite mixed in the oil used on lathe centers materially aids in obtaining proper lubrication.

Sweet oil and tripoil form an excellent coating to prevent brass work from becoming tarnished. Oxalic acid or vinegar and salt are good to remove stains from the metal.

Mechanics for Young America

Trailer for a Bicycle

Instead of using a seat on the handlebars or frame of a bicycle for my little girl, I made a trailer as shown in Fig. 1 to attach to the rear axle. I made it from old bicycle parts. The handlebars, which form the back of the seat, fasten into the seat post of an old bicycle attached to the trailer axle. The trailer is attached to the rear axle of the bicycle with two arms or forks on the ends of which are two forgings, formerly used on the rear ends of a bicycle frame, brazed in, and one of the tube projections cut off from each to make a hook as shown in Fig. 2. The piece marked E shows one of these forgings or hooks in section. The original axle of the bicycle was removed and one supplied 1 5-16 in. longer, which was turned below the threads for clearance, as shown at A. A washer, D, with a hexagon hole was fitted over the regular nut, C, on the axle and filed tapering so the forging or hook, E, on the trailer attachment could be kept in position. The washer F is held tightly against the hook by a pressure from a spring, G. The spring is held in place by a small nut, H, and cotter pin, I. This attachment makes a flexible joint for turning corners. When turning from right to left the left hook on the trailer forks stays in position, while the right hook pushes the washer F outward and relieves the strain on the fork. This attachment also makes it easy to remove the trailer from the bicycle. The washers F are pushed outward and the hook raised off the axle.—Contributed by John F. Grieves, Providence, R. I.

Fig. 2—The Hook in Position

A Window Lock

Bore a hole through the sash of the lower window and halfway through the sash of the upper window where they meet in the center and insert a heavy nail or spike. This will fasten the sash together so well that nothing short of a crowbar can pry them apart. The nail can be easily removed when the windows are to be opened.

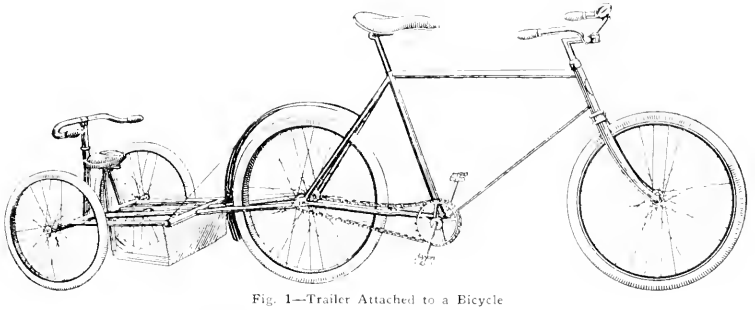
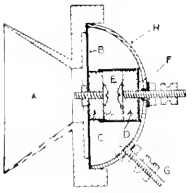


Fig. 1—Trailer Attached to a Bicycle

Home-Made Telephone Transmitter

The parts for transmitting the sound are encased in a covering, H, made from the gong of an old electric bell. A round button, D, is turned or filed from the carbon electrode of an old dry cell and a hole drilled through the center to fit in a binding-post taken from the same battery cell. This button must be carefully insulated from the shell, H, by running the binding-post through a piece of small rubber tube where it passes through the hole and placing a rubber or paper washer, F, under the carbon button, and an insulating washer under the nut on the outside. This will provide one of the terminals of the instrument. Construct a paper tube having the same diameter as the button and with a length equal to the depth of the bell case, less $\frac{1}{8}$ in. Glue or paste this tube to the button so it will form a paper cup with a carbon bottom.



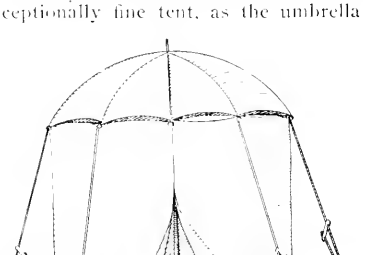
The diaphragm, B, which is the essential part of the instrument, should be made as carefully as possible from ferrotype tin, commonly called tintype tin. Cut a circular piece from this metal the exact size of the outside of the shell. A hole is made in the center of the disk a little larger than a binding-post that is taken from another old battery cell. When making the hole in the disk be careful not to bend or crease the tin. Scrape the black coating from the tin around the outside about $\frac{1}{4}$ in. wide and a place about 1 in. in diameter at the center.

The second electrode, C, is made the same as D, and fastened to the tin diaphragm with the binding-post without using any insulation. A third binding-post, G, is fastened to the shell through a drilled hole to make the other terminal. The mouthpiece, A, may be turned from wood in any shape desired, but have a flange on the back side that will make a tight fit with the outside of the shell.

Fill the paper tube with powdered carbon, E, which can be made by pounding and breaking up pieces of carbon to about the size of pin heads. Powdered carbon can be purchased, but if you make it be sure to sift out all the very fine particles. Assemble the parts as shown and the transmitter is ready for use. If speech is not heard distinctly, put in a little more, or remove some of the carbon and try it out until you get the instrument working nicely.—Contributed by Harold H. Cutter, Springfield, Mass.

Quickly Made Lawn Tent

A very simple way of erecting a lawn tent for the children is to take a large umbrella such as used on delivery wagons and drive the handle into the ground deep enough to hold it solid. Fasten canvas or cotton cloth to the ends of the ribs and let it hang so that the bottom edge will touch the ground. Light ropes can be tied to the ends of the ribs and fastened to stakes driven in the ground in a tent-like manner to make the whole more substantial and to stand against a heavy wind. This makes an exceptionally fine tent, as the umbrella



Lawn Tent Complete

is waterproof; also, there is more room to stand up in than in a tent that is in the shape of a wigwam.—Contributed by J. A. Whamer, Schenectady, N. Y.

How to Make a Windmill of One or Two Horsepower for Practical Purposes

A windmill for developing from ½ to 2 hp. may be constructed at home, the expense being very small and the results highly satisfactory.

The hub for the revolving fan wheel is first constructed. One good way to get both the hub, lining, shaft and spokes for the blades, is to go to a wheelwright's and purchase the wheel and axle of some old rig. There are always a number of discarded carriages, wagons or parts thereof in the rear of the average blacksmith's shop. Sometimes for half a dollar, and often for nothing, you can get a wheel, an axle, and connected parts. Remove from the wheel, all but the four spokes needed for the fans as in Fig. 1. The same hub, axle and bearings will do. In case you cannot secure a wheel and shaft, the hub may be made from a piece of hardwood, about 4 in. in diameter and 6 in. long. A 2-in. hole should be bored through for a wooden shaft, or a 1½-in. hole for a metal shaft. The hub may be secured by putting two or three metal pins through hub and shaft. Adjust the spokes by boring holes for them and arrange them so that they extend from the center A, like B. The wheel is then ready for the blades. These

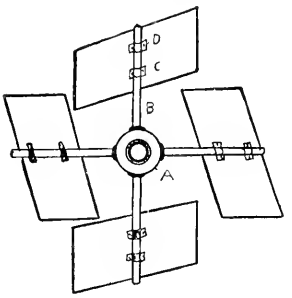


FIG. 1

blades should be of sheet metal or thin hardwood. The sizes may vary according to the capacity of the wheel and amount of room for the blades on the spokes. Each one is tilted so as to receive the force of the wind at an angle, which adjustment causes the wheel to revolve when the wind pressure is

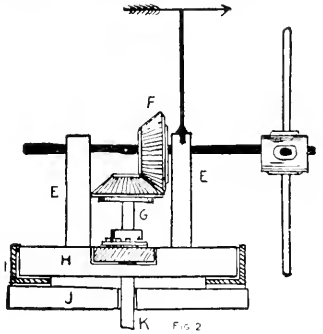


FIG. 2

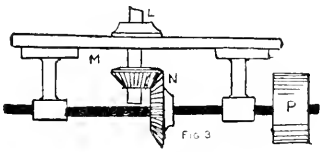


FIG. 3

strong enough. Secure the blades to the spokes by using little metal cleats, C and D. Bend these metal strips to suit the form of the spokes and flatten against the blades and then insert the screws to fasten the cleats to the wood. If sheet metal blades are used, rivets should be used for fastening them.

The stand for the wheel shaft is shown in Fig. 2. Arrange the base piece in platform order, (J). This is more fully shown in Fig. 5. On top of this base piece, which is about 36 in. long, place the seat or ring for the revolving table. The circular seat is indicated at I, Fig. 1. This ring is like an inverted cheese box cover with the center cut out. It can be made by a tinner. Size of ring outside, 35 in. The shoulders are 4 in. high and made of tin also. Form the shoulder by soldering the piece on. Thus we get a smooth surface with sides for the mill base to turn in so as to receive the wind at each point to advantage. The X-shaped

piece H rests in the tin rim. The X-form, however, does not show in this sketch, but in Fig. 5, where it is marked S. This part is made of two pieces of

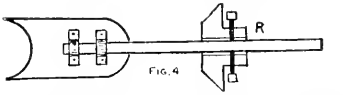


FIG. 4

2-in. plank, about 3 in. wide, arranged so that the two pieces cross to make a letter X. When the pieces join, mortise them one into the other so as to secure a good joint. Adjust the uprights for sustaining the wheel shaft to the X-pieces as shown at E, E, Fig. 2. These are 1 by 1 in. pieces of wood, hard pine preferred, planed and securely set up in the X-pieces by mortising into the same. Make the bearings for the

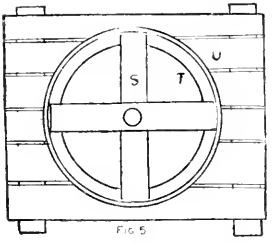


FIG. 5

wheel shaft in the uprights and insert the shaft.

The gearing for the transmission of the power from the wheel shaft to the shaft calculated for the delivery of the power at an accessible point below must next be adjusted. The windmill is intended for installation on top of a building, and the power may be transmitted below, or to the top of a stand specially erected for the purpose. It is a good plan to visit some of the second-hand machinery dealers and get four gears, a pulley and a shaft. Gears about 5 in. in diameter and beveled will be required. Adjust the first pair of the beveled gears as at F and G. If the wheel shaft is metal, the gear may be set-screwed to the shaft, or keyed to it. If the shaft is hardwood, it will be necessary to arrange for a special connection. The shaft may be wrapped with sheet metal and this metal fastened on with screws. Then the gear may be attached by passing a pin through the set-screw hole and through the shaft. The upright shaft like the wheel shaft is best when of metal. This shaft is shown extending from the gear, G, to a point below. The object is to have the shaft reach to the point where the power is received for the service below. The shaft is shown cut off at K. Passing to Fig. 3 the shaft is again taken up at L. It now passes through the arrangement shown, which device is rigged up to hold the shaft and delivery wheel P in place. This shaft should also be metal. Secure the beveled gears M and N as shown. These transmit the power from the upright shaft to the lower horizontal shaft. Provide the wheel or pulley, P, with the necessary belt to carry the power from this shaft to the point of use.

The tail board of the windmill is illustrated in Fig. 4. A good way to make this board is to use a section of thin lumber and attach it to the rear upright, E of Fig. 2. This may be done by boring a hole in the upright and inserting the shaft of the tail-piece. In Fig. 4 is also shown the process of fastening a gear, R, to the shaft. The set screws enter the hub from the two sides and the points are pressed upon

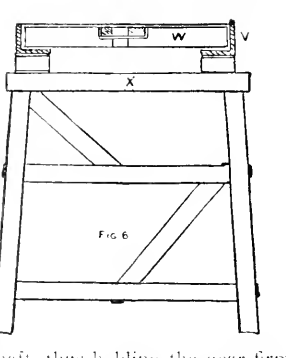


FIG. 6

the shaft, thus holding the gear firmly in place. The platform for the entire wheel device is shown in Fig. 5. The

X-piece S is bored through in the middle and the upright shaft passes through. The tin run-way or ring is marked T, and the X-piece very readily revolves in this ring, whenever the wind alters and causes the wheel's position to change. The ring and ring base are secured to the platform, U. The latter is made of boards nailed to the timbers of the staging for supporting the mill. This staging is shown in Fig. 6, in a sectional view. The ring with its X-piece is marked V, the X-piece is marked W, and the base for the part, and the top of the stage is marked X. The stage is made of 2 by 4-in. stock. The height may vary, according to the requirements. If the affair is set up on a barn or shed, the staging will be sufficient to support the device. But if the stage is constructed direct from the ground, it will be necessary to use some long timbers to get the wheel up high enough to receive the benefit of the force of the wind. Proceeding on the plan of the derrick stand, as shown in Fig. 6, a stage of considerable height can be obtained.

To Renew Old Dry Batteries

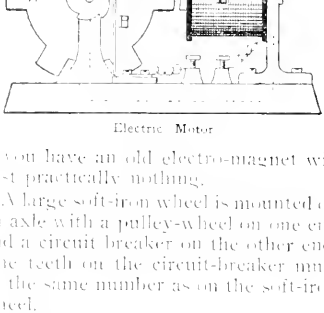
Remove the paper that covers the cell and knock several good-sized holes in the zinc shell. Place the battery in a glass jar, fill it two-thirds full of strong sal ammoniac (or salt) solution and connect the terminals to whatever apparatus the current is to be used for. A few drops of sulphuric acid quickens and improves the action. The output of the cell will be nearly as great as when the battery was first bought. Contributed by C. W. Arbitt, Austin, Texas.

Prussian blue and Chinese blue are both the same chemically but they do not cut or look the same.

When an acetylene lamp is in good order it will light up slowly with a hissing noise followed by a pure white flame. Should the lamp light up quickly with a yellowish flame, it is a sign of a leak somewhere.

Another Electric Motor

This form of electric motor is used largely in England in the form of an indicator. It is very easily made and



Electric Motor

if you have an old electro-magnet will cost practically nothing.

A large soft-iron wheel is mounted on an axle with a pulley-wheel on one end and a circuit breaker on the other end. The teeth on the circuit-breaker must be the same number as on the soft-iron wheel.

The electro-magnet is mounted so that its core is level with the axle and in a line with the wheel. One wire from it is attached to one binding screw and the other end is grounded to the iron frame that supports it. This frame is connected to the frame supporting the wheel. A small brush presses on the circuit-breaker and is connected to the other binding screw.

In the diagram A represents the iron wheel; B, the brush; C, the circuit-breaker; D, the magnet. The wire connecting the two frames is shown by a dotted line.

To start the motor, attach your battery to the screws and turn the wheel a little. The magnet attracts one of the teeth on the wheel, but as soon as it is parallel with the core of the magnet the circuit is broken and the momentum of the wheel brings another tooth to be attracted.

To reverse the motor reverse the connections and start the wheel the other way. Be sure that the frames are screwed down well or the motor will run jerkily and destroy the connections. Contributed by E. Crawford Curry, Brockville, Ontario.

How to Make a Propelling Vehicle

Any boy, with a little knack and a few odd tools, can rig up various contrivances which will be a source of pleasure to himself and oftentimes can be sold, to less ingenious boys, for a snug little sum. Any tool a boy can obtain is apt to be of use to him, chisel, bit, jack-knife or hammer.

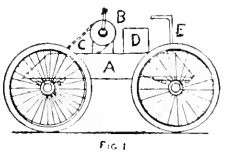


FIG. 1

Figure 1 shows what two boys did with old cycle wheels. They went to some junk shops where the concerns had purchased cast-away bicycles and noticed that there were numerous wheels in very good order that could be selected from among the sets of wheels with broken or bent rims, spokes, burst tires, etc. In fact, the lads had no trouble in getting several sets of bicycle wheels in good condition for very little money. These wheels were taken to the back-yard shop of the boys where the young fellows had rigged up a shed-like affair and put in a bench. The previous Christmas one of the boys received a box of tools as a gift, in which was included a little hand vise and the required tools for general boy's handiwork.

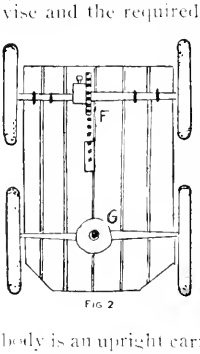


FIG 2

Four of the cycle wheels they used in making the hand-propelled vehicle shown at Fig. 1.

A wooden body, A, made of smooth boards rests upon shafts. Fixed on this body is an upright carrying the sprocket B. The upright is a piece of wood about 10 in. high and 1 in. wide, fitted with one of the bearings from the cycle. The regular cycle chain sprocket is used at B as well as upon the shaft. The regular chain of the cycle is likewise employed, so, when buying the wheels, it is well to select one or more chains with corresponding sprockets from the junk heap. The detail of the adjustment of the parts is shown in next views. The letter D signifies the seat which is a box. The steering gear is a bent iron rod, also found in the waste pile of the junk shop, and is bent to right form by heating and bending over on a rock or any solid matter. The steering rod is marked E. It fits into a socket in the shaft of the forward wheels.

Figure 2 shows the construction of the cart below. The cog is keyed or set-screwed to the driving shaft of the wheels with either key or set-screw used in original fastening, as the case may be. The chain is marked F, and there is a slot cut in the floor of the cart to let the chain pass up and through to the cog on the propelling shaft crank. The disk which receives the steering rod is at G. The forward shaft bears only at the center upon a disk of metal, consisting of any circular piece found among the pieces of iron or brass at the junk store. One can get nearly all the mechanical parts in junk establishments that purchase parts of out-of-date or cast-away bicycles. The detail of the driving shaft is shown at Fig. 3. The sprocket wheel is at H and this is just as it is taken from the original bicycle shaft. The bearings consist of wires looped around the shaft and inserted into holes bored in metal plates as shown. These plates are screwed to the bottom of the cart.

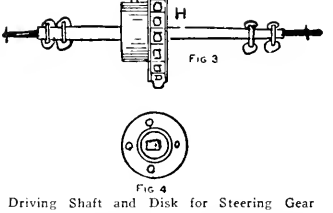


FIG 3

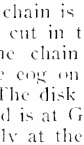


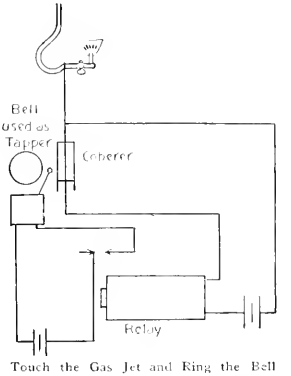
FIG 4

Driving Shaft and Disk for Steering Gear

The shaft itself is found in rods or even cast-away metal axles which are commonly found in most any carriage works, cycle shops or junk dealer's. Figure 4 shows the disk that receives the steering gear. The disk is bored around edges for the securing screws, while the center is open for the steering rod. When put together, three boys usually ride. One steers and the other two turn the crank. Freight can be carried and some boys do quite an express business in their town with one of the carts like this that they made.

Ringing a Bell by Touching a Gas Jet

The experiment of scuffling the feet over a carpet and then producing a spark which will light the gas by touching the chandelier is described on another page. One of our correspondents says that if a wire is connected to the chandelier and led to one terminal of the coherer of a wireless telegraph outfit the bell will ring every time the



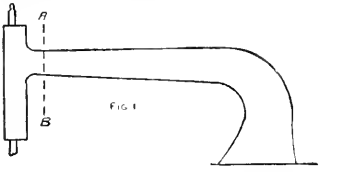
Touch the Gas Jet and Ring the Bell

spark is produced by touching the chandelier, and that, as the chandeliers are all connected by the gas-pipe, the bell will ring, no matter in which room the spark is produced.

The covering quality will be greatly improved if some dry red lead is added to the shellac varnish used for killing knots.

How to Make a Wood-Turning Lathe Out of an Old Sewing Machine

With a hack-saw, cut off the arm containing the needle on line AB, Fig. 1, leaving the shaft only. On the end of the shaft will be found a round plate,



in which drill four 3/16-in. holes. Now secure, or have turned, a piece of iron or steel 1½ in. in diameter, Fig. 2. Drill and countersink four 3/16-in. holes in it to fit the holes on the shaft plate. File a spur center 5/16 in. long, and two side points 3/16 in. long. Bolt this plate to the shaft plate with four flat-headed stove bolts, 3/16 in. in diameter by ⅝ or ¾ in. long, Fig. 3.

For the bed, use a board 32 in. long and as wide as the base of the machine arm. This gives a limit of 2 ft. between spur and dead centers. Let this board be made level with the rest of machine table by making a pair of legs if needed. Next make a T-rail, Fig. 4, of two boards, one 5 by ¾ by 32 in., the other 3½ by ¾ by 32 in. Three-quarter inch of the wider board projects over each of the smaller boards. Nail firmly and clinch nails, or screw together. Screw this rail on the machine board so that its center coincides exactly with the machine centers. Bore a number of ⅜-in. holes with centers 2¾ in. apart along the center line of this rail, beginning 6 in. from the end nearest the machine. Make another T-rail for slide tool rest, of two pieces 32 by 3 by ¾ in., and 32 by 1½ by ¾ in. Fasten this in front of the larger T-rail and parallel to it, the center lines being 6½ in. apart.

To make the tail-piece, that is, the part to hold wood to be turned, get a board 6½ by 7 by ¾ in., and on the edges, Fig. 5, A, screw two pieces 7 by ¾ by 1½ in. so that the cap thus

made will fit snugly over the large T-rail. Fasten to these last two pieces, threaded to fit the crank, on the head-end of the crank block, and a plain nut

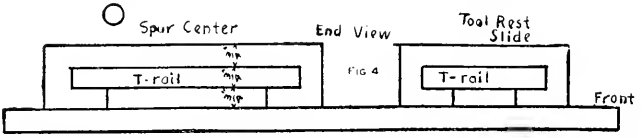


FIG 4

with screws, two more pieces 7 by $3/4$ by $3/4$ in., Fig. 5, B. This tail-piece should move smoothly back and forth with no side motion. Now get a block of hardwood 1 by $2\frac{1}{4}$ in., and $1\frac{3}{4}$ in. higher than the spur center when mounted on the middle of the tail-piece just described. At exactly the height of the spur center bore through this block a $3/4$-in. hole, Fig. 5. Have a blacksmith make a crank 8 in. long, threaded for 5 in. as shown. At the dead center end taper the crank and make a cup center, out of which allow a 3 16-in. point to project. The cup prevents the point from boring into

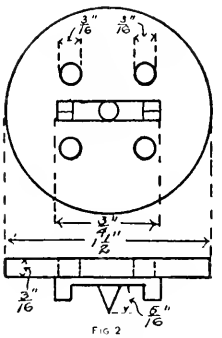


FIG 2

to act as a bearing, on the crank end. One and one-half inches from the back of the tail-piece bore a $3/8$-in. hole. Make a peg $3/8$ by 2 in. To put in a piece of wood to turn, move the tail-piece back until the head end is over the center of the hole nearest the end of the block, then the peg will slip into second hole from the head end of the tail-piece, and into a corresponding T-rail hole, pinning the two together. Insert wood and screw up dead center to hold it.

For a tool rest make a second piece like the base of the tail-piece, 11 in. long and fitting the small T-rail. Cut out two blocks $1\frac{1}{2}$ by $2\frac{1}{4}$ by $3/4$ in. and screw them, one on each end of the base of the tool rest, covering the half farthest from the centers, and having an 8-in. space between blocks. On the tops of these blocks screw a strip 11 by $2\frac{1}{4}$ by $3/4$ in. Now for the rest proper, cut out a board 8 by 11/16 by 9 in. to slide in the slot of the rest. Take a piece of oak 11 by 2 in., and high enough so that the top will be level with the centers of the lathe, and bevel

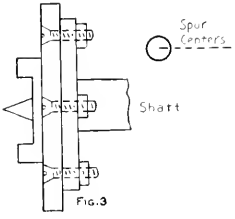


FIG.3

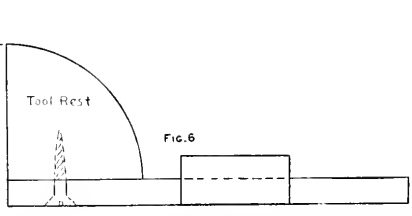
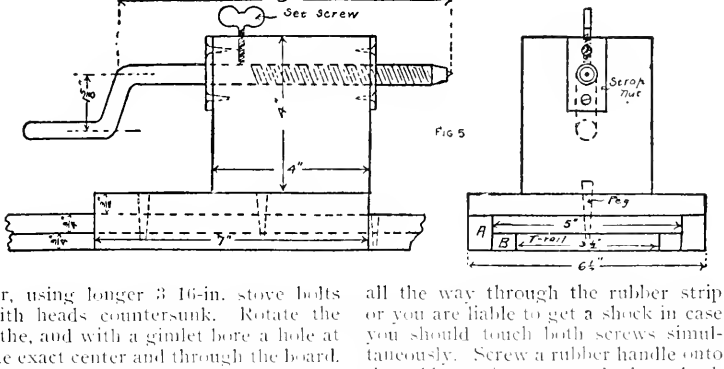


FIG.6

wood too rapidly. One inch from the outer end of the crank block, Fig. 5, bore a 3 16-in. hole, and force a $1/4$-in. bolt to cut its thread in the wood. This is a set screw to hold the crank in any position desired. Place a strap nut, as shown in Fig. 6. Screw on one end of the 8 by 9-in. piece exactly in the middle. This piece will slide in and out, closer or farther from the centers as desired, and also along the T-rail.

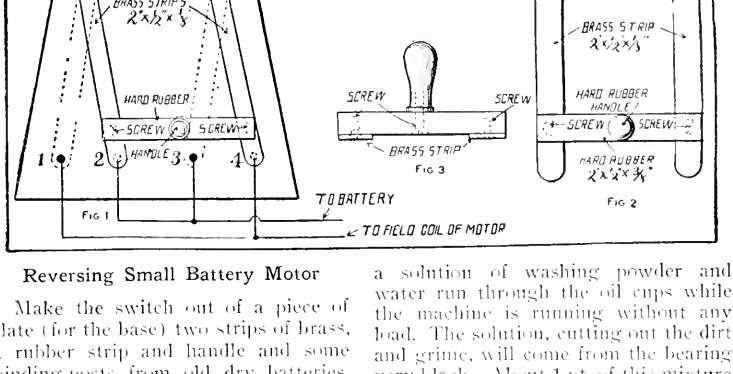
A center for turning rosettes, saucers,

etc., may be made as follows: Remove the spur center and bolt in its place a 1-in. circular board of the same diameter, using longer 3 16-in. stove bolts with heads countersunk. Rotate the lathe, and with a gimlet bore a hole at the exact center and through the board. Now take off the board and countersink on the back a place for the head of a coarse threaded screw. Turn in a $1^3/_4$-in. screw, replace the board and any block held on the end of the rotating screw will turn on and be held while being turned.—Contributed by L. L. Winans, Mexico, Mo.



and 4. Hold the brass strips apart by means of the hard rubber strip and screws. Do not let the screws come all the way through the rubber strip or you are liable to get a shock in case you should touch both screws simultaneously. Screw a rubber handle onto the rubber strip to move the lever back and forth with. Fig. 2 shows the arrangement of strips, handle, screws, etc., in detail. Fig. 3 is an end view of the same.—Contributed by Eugene F. Tuttle, Jr., Newark, Ohio.

Bronze bearings may be cleaned with a solution of washing powder and water run through the oil cups while the machine is running without any load. The solution, cutting out the dirt and grime, will come from the bearing very black. About 1 pt. of this mixture should be run through each bearing, then clean thoroughly with clear water.



Reversing Small Battery Motor

Make the switch out of a piece of slate (for the base) two strips of brass, a rubber strip and handle and some binding-posts from old dry batteries. Fasten the brass strips at 5 and 6, Fig. 1, so they can swing from 1 and 3 to 2

A Water Candlestick

A glass of water makes a fine emergency candlestick. Weight one end of the candle with a nail just large enough to hold the candle in the water so that the water comes near its top edge, but does not touch the wick, and then light the candle.

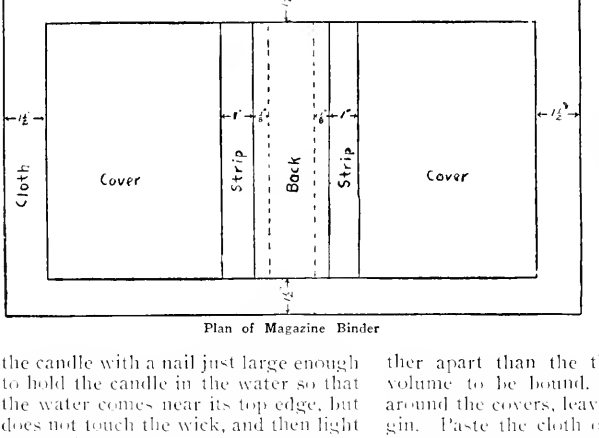
It will burn until the last vestige of wick is gone and the flame will not flicker. The melted tallow that runs down but serves to hold the candle more stationary.

How to File Soft Metals

When filing soft metals, such as solder or babbitt metal, the file, after a few strokes, will become filled with metal, causing scratches on the surface being filed. The surface may be filed smooth, provided the file has been well oiled. The oil prevents the cutters from clogging and also allows the metal to yield easily. Oil the file every few minutes and use a card frequently in cleaning and the work will be smooth. —Contributed by Jno. E. Ganaway, Paducah, Ky.

To Make a Magazine Binder

Get ½ yd. of cloth, one shoestring, a pasteboard box for covers, and some heavy paper. Cut the pasteboard into two covers, ¼ in. larger all around than the magazine, except at the back with which they should be even. Next cut a strip 1 in. wide off the back of each cover. Place the covers on the cloth, Fig. 1, with the back edges ¼ in. farther apart than the thickness of the volume to be bound. Cut the cloth around the covers, leaving 1½ in. margin. Paste the cloth on the covers as they lay, and turn over the 1½ in. margin, pasting down smoothly. Cut a piece of stiff paper to fit and paste on the back. Take a piece of cloth as wide as the cover, and long enough to extend over the back and 1½ in. beyond each "strip." Paste on to hold all together. Two pieces of paper the exact size of the magazine, pasted on the inside of each cover protects the edges of the cloth, and adds to the appearance. Let dry slowly.



Plan of Magazine Binder

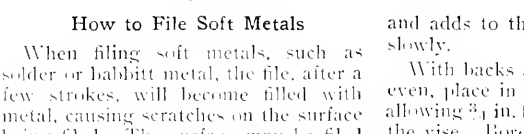


Fig. 2
Magazine Binder Complete

With backs and edges of magazines even, place in a vise and set up tight allowing ¾ in. from back to show above the vise. Bore three 3/16-in. holes ½ in. from the back, one in the middle, the other two 1½ in. from each end. Make corresponding holes in the strips of the binder and use the shoestring to complete as in Fig. 2.

A piece of wire solder makes a good temporary spline for the draftsman.

Mechanics for Young America

A Library Set in Pyro-Carving

By Helen Westinghouse

The multitude of indifferently executed small articles which followed the introduction of pyrography is beginning to disappear, people are considering the art more seriously and applying it to more dignified uses. Pyro-carving is one of the new methods of decorating furniture which is both beautiful and practical, two qualities which do not always go together.

The library set illustrated consists of a table 30 by 50 in. with two benches, 14 in. wide of the same length. The supports are made of selected white pine, which must be absolutely free from pitch. The pine is soft enough to work easily with the point and stands wear much better than basswood. The tops and braces are made of curly fir, all of the material must be 2-in. lumber, which dresses to about an inch and a half. All surfaces, except the faces of the supports, are given a well-rubbed coat of oil with a little burnt umber, the stain to be applied directly to the wood without a filler.

On the outside of the supports the design is drawn in with pencil, the background is then cut out smoothly with a chisel to the depth of an eighth of an inch, leaving the decoration in relief. It is then burned deeply, the background in straight flat strokes, the outlines having the effect of a sloping, dark edge. The shadows are burned in as deeply as possible and the shading is put in with the flat of the point.

A wax or egg-shell oil varnish finish is most suitable for this set.

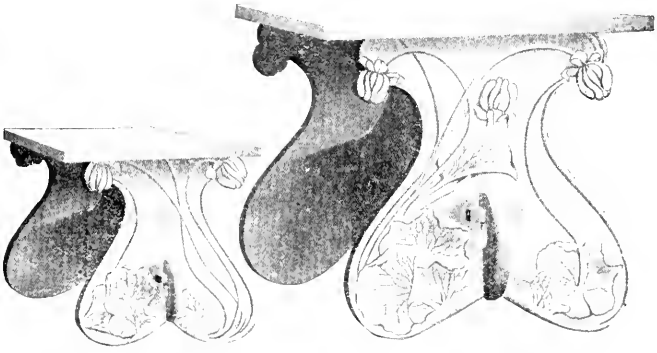


Table and Seat Decorated in Pyro-Carving

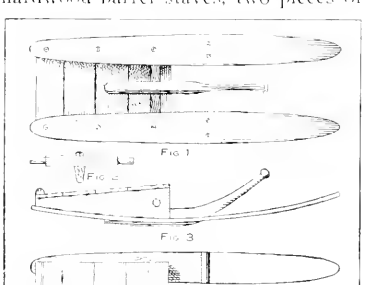
A Phoneidoscope

The phoneidoscope has many and varied forms, but the simplest can be made by bending the forefinger and thumb so as to form a circle and then drawing a soap film across them. This is done similar to blowing soap bubbles.

The angle with the direction of the light may be readily adjusted by turning the wrist, a motion of the elbow alters the distance from the mouth and the tension of the film can be regulated by moving the thumb and forefinger. Singing or speaking at the film when under proper tension will cause beautiful figures to appear, which may be reflected from the film directly on the screen.—Contributed by Robt. E. Bradley, Winchester, Mass.

A Home-Made Yankee Bobsled

A good coasting sled, which I call a Yankee bob, can be made from two hardwood barrel staves, two pieces of



Runners Made of Barrel Staves

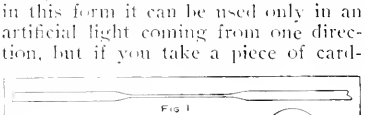
2 by 6-in. pine, a piece of hardwood for the rudder and a few pieces of boards. The 2 by 6-in. pieces should be a little longer than one-third the length of the staves, and each piece cut tapering from the widest part, 6 in., down to 2 in., and then fastened to the staves with large wood screws as shown in Fig. 1. Boards 1 in. thick are nailed on top of the pieces for a seat and to hold the runners together. The boards should be of such a length as to make the runners about 18 in. apart.

A 2-in. shaft of wood, Fig. 2, is turned down to 1 in. on the ends and put through holes that must be bored in the front ends of the 2 by 6-in. pieces. A small pin is put through each end of the shaft to keep it in place. The rudder is a 1½-in. hardwood piece which should be tapered to ½ in. at the bottom and shod with a thin piece of iron. A ½-in. hole is bored through the center of the shaft and a lag screw put through and turned in the rudder piece, making it so the rudder will turn right and left and, also, up and down. Two cleats are nailed to the upper sides of the runners and in the middle lengthways for the person's heels to rest against.

Any child can guide this bob, as all he has to do is to guide the rudder right and left to go in the direction named. If he wants to stop, he pulls up on the handle and the heel of the rudder will dig into the snow, causing too much friction for the sled to go any further.—Contributed by Wm. Algie, Jr., Little Falls, N. Y.

How to Make a Small Microscope

Theoretically a simple microscope can be made as powerful as a compound microscope, but in practice the minute size required by the simple lens to give the highest power makes it almost impossible to be used. However, a lens having a reasonable magnifying power can be made in a few minutes for almost nothing. Take a piece of glass tubing, heat one place in a hot flame, hold one end and pull on the other and draw the heated place down to a fine string as shown in Fig. 1. Take about 3 in. of this fine tube and heat one end which will form a glass bead as shown in Fig. 2. This bead is the lens. When in this form it can be used only in an artificial light coming from one direction, but if you take a piece of card-



Lens Formed by Heat

board and bore a hole in it a little smaller than the bead on the glass tube which is forced into the hole, Fig. 3,

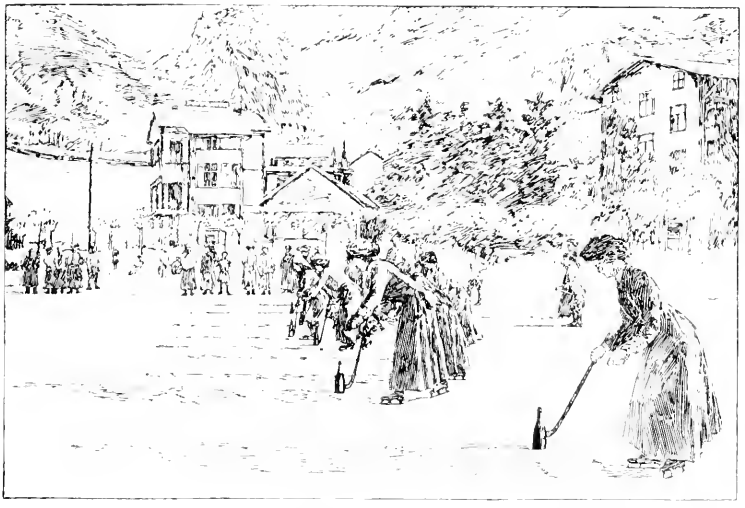
you can use this mounted lens in ordinary daylight. In this case a mirror must be used to reflect the light up through the lens. It is difficult to see anything at first, as the lens must be held very close to the eye, but in practice you will soon learn to see the object as it appears enlarged.

If you soak a little dried grass or hay in water for a few days and look at a drop of this water, germs in various life forms can be seen. The water must be put on the lens. One thing to remember is that the smaller the lens, the greater the magnifying power.—Contributed by Daniel Gray, Decatur, Illinois.

The water in hot water supply pipes will freeze quicker than water that has not been heated. This is because the air, which is a poor conductor of heat, has been driven out by the heat.

How to Carry Books

Almost all school children carry their books with a strap put around and buckled very tight. This will make dents in the cover where the board overlaps the body of the book. If the strap is left loose, the books are liable to slip out. Place the cover of one book between the cover and fly leaf of its neighbor and the difficulty will be remedied. This will place the books in alternate directions. Books stacked in this manner do not require the strap buckled tight, or, they can be carried without any strap just as well.—Contributed by Thos. De Loof, Grand Rapids, Mich.



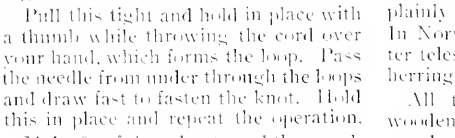
BOTTLE PUSHERS.—This is a game in which the competitors push bottles on the ice with hockey sticks. All the bottles must be the same size and make. The persons participating must keep their bottles upright at all times. The bottles are lined up for the start and at the word "go," each person pushes a bottle across the field for a distance that is agreed upon.

How to Make a Hammock

Any one can make a hammock as good as can be bought and that at a cost so small that every member of the family can possess one providing there are places enough for hanging them.

The materials required are a needle about 7 in. long, and with a big eye, an iron ring for each end of the hammock, two long smooth sticks on which to knit the hammock and two pounds of strong hemp cord or twine. The twine may be colored in any color or combination of colors desired. A Roman stripe at each end of the hammock makes a pretty effect.

A hammock 15 in. wide will not be too large for solid comfort. To knit it first thread the big needle and holding it in the left hand, hold the cord in place with the thumb until you have looped the cord over the tongue, then pass the cord under the needle to the opposite side and catch it over the tongue. Repeat this operation until the needle is full. Cut a 2-yd. length of cord and make a loop and fasten to the door knob or to some other convenient place. Tie the cord on the needle to this loop 3 in. from the end of the loop. Place the small mesh stick under the cord with the beveled edge close to the loop, and, with a thumb on the cord to hold it in place, pass the needle around the stick and then, point downward, pass it through the loop from the top,



The Water Telescope

and then bring it over the stick so forming the first half of the knot.

Pull this tight and hold in place with a thumb while throwing the cord over your hand, which forms the loop. Pass the needle from under through the loops and draw fast to fasten the knot. Hold this in place and repeat the operation.

Make 30 of these knots and then push them off the stick and proceed in the same way with the next row, passing the needle first through each of the 30 knots made for the first row. Make 30 rows and then tie the last loops to the other iron ring. Stretchers may be made and put in place and the hammock, strong and durable, is finished. The work must be carefully and evenly done. One is apt to have a little trouble getting the first row right, but after that the work proceeds quite rapidly.

How to Obtain Cheap Dry Batteries

Not very many people realize that good, serviceable dry cells can be obtained from an automobile garage very cheap. These cells having been "run out" beyond the required number of amperes for automobile use, will give excellent service, considering their cost. Many of them will give two-thirds of their original amperage. Six of such cells have been in use on my door-bell circuit for nearly a year. They can be used for other purposes just as well.—Contributed by H. H. Cutter.

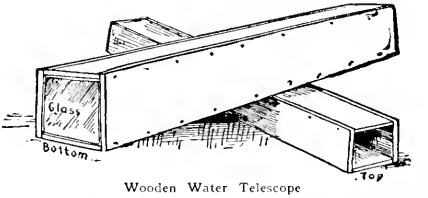
How to Make a Water Telescope

Before you decide on a place to cast your hook it is best to look into the water to see whether any fish are there. Yes, certainly, you can look into the water and see the fish that are there swimming about, if you have the proper equipment. What you need is a water telescope. This is a device made of wood or metal with one end of glass. When the glass end is submerged, by looking in at the open end, objects in the water are made plainly visible to a considerable depth. In Norway, the fishermen use the water telescope regularly in searching for herring shoals or cod.

All that is necessary to make a wooden water telescope is a long wooden box, a piece of glass for one

end and some paint and putty for making the seams watertight. Fix the glass in one end of the box, and leave the other open to look through.

A tin water telescope is more convenient than the wooden one, but more difficult to make. The principal essential for this is a circular piece of glass for the large end. A funnel shaped tin horn will do for the rest. Solder in the glass at the large end and the telescope is made. Sinkers consisting of strips of lead should be soldered on near the bottom to counteract the buoyancy of the air contained in the watertight funnel and also helps to submerge the big end. The inside of the funnel should be painted black to prevent the light from being reflected on the bright surface of the tin. If difficulty is found in obtaining a circular piece of glass, the bottom may be made square and square glass used. Use plain, clear glass; not magnifying glass. To picnic parties the water telescope is of great amusement, revealing numerous odd sights in the water which many have never seen before.



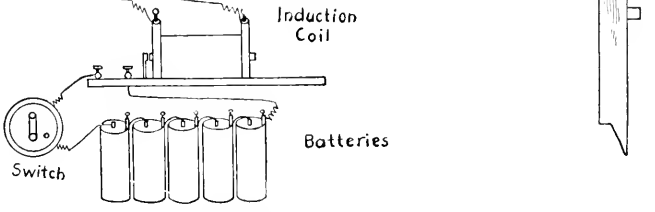
Wooden Water Telescope

How to Rid Your Yard of Cats

The following is a description of a device I built at my home in Brooklyn, which not only gave us relief from the nightly feline concerts, but also furnished much amusement to my friends.

I first ran two bare copper wires along the top of the fence about 1 in. apart, fastening them down with small staples, care being taken that they did not touch. To the ends of these wires I fastened ordinary insulated bell wire, running them to the house and connecting them to the upper binding-posts of an induction coil; I then ran a wire from the lower binding-post of my coil through the batteries back to the other lower binding-post of coil, breaking the circuit by putting in an ordinary switch. The more batteries used, the stronger the current. The switch should always be left open, as it uses up the current very rapidly.

When "tabby" is well on the wires I close the switch and she goes the length of the fence in bounds, often coming back to see what the trouble is, thus receiving another shock.—Contributed by Charles L. Pultz.

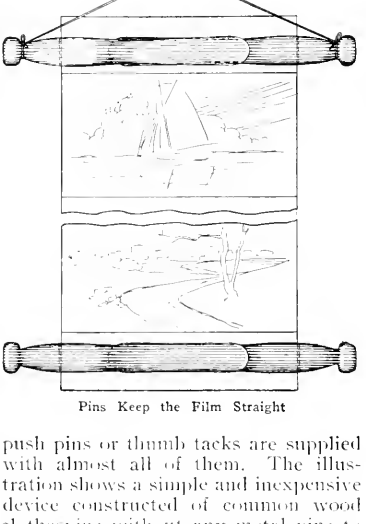


Electric Apparatus for Driving Away Cats

A gouge may be used as a substitute bit if a proper sized bit is not at hand. The gouge can be placed in the brace the same as a bit.

Drying Films

The drying of photographic film in full lengths without scratching or curling is quite difficult. Various devices are used to keep the film straight, and



Pins Keep the Film Straight

push pins or thumb tacks are supplied with almost all of them. The illustration shows a simple and inexpensive device constructed of common wood clothespins without any metal pins to come in contact with the film and cause rust streaks. A pair of pins are fastened at each end of the film by pushing one pin over the other which in turn is clamped on the film. A string tied to the heads of one pair of pins provides a way to hang the whole on a nail. The lower pair of pins makes a weight to keep the film straight.—Contributed by J. Mac Gregor, Montreal, Canada.

Grooved Pulley Made from Sheet Tin

A grooved pulley which will run true and carry a round belt may be made without the use of other tools than a compass and pair of shears, with a drill or punch for making two rivet holes.

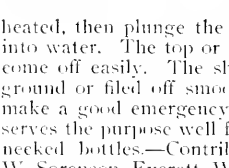
Lay off a circle on the tin, of the diameter desired for the bottom of the groove. Then lay off a concentric circle of ¼ in. greater radius. Cut out along the lines of the large circle. On the line of the small circle mark with a prick punch or nail a series of slight dents, about ¼ in. apart, all the way around. Now make cuts from the line of the large circle to these dents, stopping when the shears give the little "click" on entering the dent. Bend the little tongues thus formed alternately to the right and left, then by shaping them with some care you will have a good running surface for the belt. It will not make any difference if there are more tongues on one side than the other, or if they are not equally spaced, within reason.

For the hub, solder or rivet a "handle" across the center hole and drill a hole through it of the same size as the center hole. With the help of solder a grooved pulley which will answer almost every experimental purpose may be made, and it is remarkable with how slight care a perfectly true wheel may be made in this manner.

The same principle might in some way be applied to gear-wheels, for light and temporary use.—Contributed by C. W. Nieman, New York City.

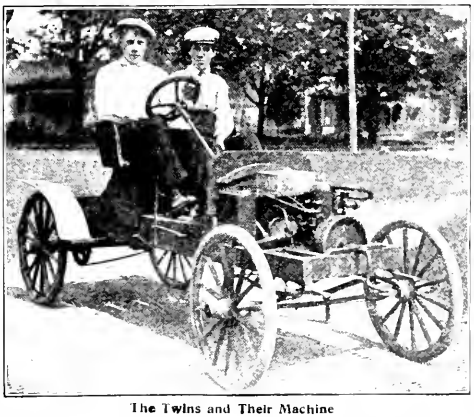
An Emergency Glass Funnel

Secure a glass bottle having a small neck and tie a string saturated in kerosene around the outside at A and B as shown in the sketch. Light the string and allow it to burn until the glass is heated, then plunge the bottle quickly into water. The top or neck will then come off easily. The sharp edges are ground or filed off smooth. This will make a good emergency funnel which serves the purpose well for filling wide necked bottles.—Contributed by Jos. W. Sorenson, Everett, Wash.



Two Boys Build an Automobile

The accompanying engravings show the completed work of twin boys, Wilford and Winfurd Goddard, 15 years of age. The boys started out with no other material than what they could collect around their own home. No suggestions were received by them and they designed and completed the work of building an automobile with the exception of the gasoline engine. This engine they purchased from their earnings. The automobile is about 8 ft. long, with a 40-in. tread.

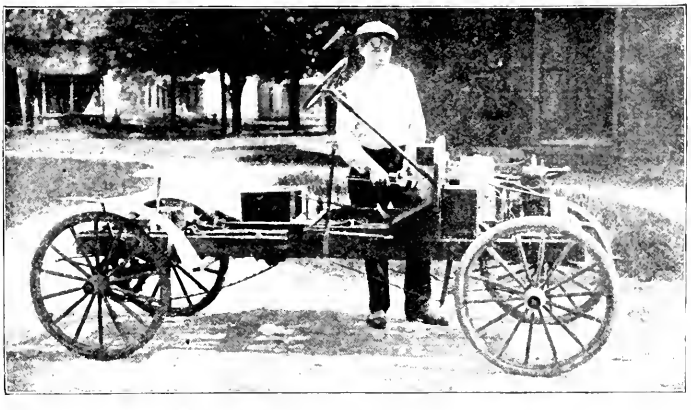


The Twins and Their Machine

The driving arrangement from the engine to the rear axle is connected to a cone clutch which in turn is connected to a chain drive. The wheels were made from large carriage wheels cut down to the proper size and fitted with 28-in. rims. The tires are standard bicycle tires with an extra cover. On a trial trip it carried four boys 6 miles, up and down hills and over sandy roads, at a speed of about 10 miles an hour.

◆ ◆ ◆

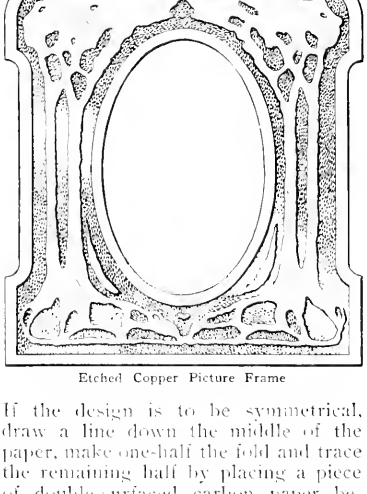
A scientist has calculated that the eyelids of the average man open and shut no fewer than 1,000,000 times in the course of a single year of his existence.



Side View: Seat Removed to Show Construction

How to Make an Etched Copper Picture Frame

Secure a heavy piece of copper about 8 or 10 gauge, cut to 7 by 13¼ in. Make a design on a piece of paper. The accompanying sketch offers a suggestion.



Etched Copper Picture Frame

If the design is to be symmetrical, draw a line down the middle of the paper, make one-half the fold and trace the remaining half by placing a piece of double-surfaced carbon paper between the halves. Fasten this design with a little paste on the copper at two of its corners and trace it on the copper by means of the carbon paper.

Remove the paper, and, with a small brush and black varnish or asphaltum paint, cover the part not to be eaten by the acid of the bath into which the metal is to be immersed. Two or three coats will be necessary to withstand the acid. The conventional trees, the border as shown in the illustration, and the back are covered with the varnish or asphaltum.

The etching solution should be put in a stone vessel of some kind and care should be taken not to allow it to get on the hands or clothes. A stick should be used to handle the metal while it is in the solution. This solution is made by putting in the stone jar the following: Water a little more than one-half, nitric acid a little less than one-half. *Do not add the water to the acid.* Leave the metal in this solution three or four hours. The time will depend upon the strength of the acid and the depth to which you wish the etching to be done. An occasional examination of the object will show when to take it out.

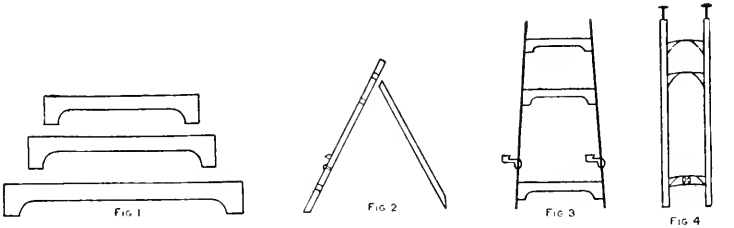
When the etching has been carried as far as desirable, take the copper from the bath and remove the asphaltum by scraping it as clean as possible, using an old case knife. After doing this, put some of the solution, or pickle as it is called, in an old pan and warm it over a flame. Put the metal in this hot liquid and swab it with batting or cloth fastened to the end of a stick. Rinse in clear water to stop the action of the acid. When clean, cut the metal out from the center where the picture is to be placed, using a metal saw.

Solder on the back several small clips with which to hold the picture in place. There must also be a support soldered in place to keep the frame upright. To further clean the metal before soldering, use a solution in the proportion of one-half cup of lye to 3 gal. water. Heat either the solution or the metal just before using.

When soldering, care must be taken to have the parts to be soldered thoroughly clean. Any grease or foreign matter will prevent the solder from running properly. On a piece of slate slab, heavy glass or other hard, non-absorbent substance that is clean, put a little water and grind a lump of borax around until the resultant is like thin cream. Thoroughly clean the parts that are to be soldered by scraping with a knife, and do not touch with the fingers afterward. Place a piece of thin silver solder between the parts after having coated them and the solder with the borax. Use a pair of tweezers to pick up the solder. Hold the parts firmly together and apply heat—slowly at first until all moisture has been expelled and the borax crystallized, after which the flame may be applied more directly and the parts brought to a soldering heat. An alcohol flame will

do. Heat applied too quickly will throw off the solder and spoil the attempt.

painted in some pretty tint, or, if preferred, may be enameled.—Contributed by G. J. Tress.



Details of Easel Construction

There are various ways of finishing the metal. It may be polished by means of powdered pumice, chalk or charcoal, and then treated with a coat of French varnish diluted ten times its volume in alcohol. Another popular way is to give the background a bluish-green effect by brushing it over a great many times, after it has been cleaned, with a solution composed of muriate of ammonia, 1 part; carbonate of ammonia, 3 parts; water, 24 parts. The whole may then be treated with French varnish to preserve the colors.

How to Make an Easel

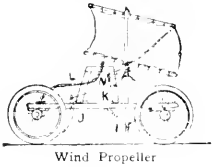
A strong and substantial easel may be made at home with very little expense and no great difficulty.

Smooth down with a plane, four pieces of pine, 1 in. thick, 1 in. wide and 4 ft. long, until suitable for legs. Make three cross-pieces, Fig. 1, and join the legs with them as shown in Fig. 2. With an auger bore a hole in each leg about 3 in. from the bottom, and fit into each a little peg, Fig. 2, for the picture to rest on. The peg should be of hardwood so it will not break.

Cut the handle from an old broom, measure off the right length, and put a hinge on one end. Fasten this leg on the second cross-piece, thus forming a support for the two front legs, Fig. 3. The easel may be finished according to the individual taste. It may be sandpapered and stained and varnished, or

How to Make a Wind Propeller

A wind propeller may be constructed with four old bicycle wheels arranged with shafts pretty much like the shafts of a hand-propelled cart. The platform is flatter, however, and the body one tier so that it is lower. A framework of wood is built at M and this is a support for several purposes. The sail is secured to the mast which is fixed into the body of the cart as shown. The sail is linen fabric. There are two cross-pieces to aid in keeping the sail properly opened. The steering arrangement is through the rear shaft. The shaft is pivoted as in a hand-propelled cart, and the rod I extends from the middle connection of the shaft up to a point where the person seated on the wooden frame can handle it. There is a brake arranged by making a looped piece J and hinging it as shown. This piece is metal, fitted with a leather face. The cord K is pulled to press the brake. L marks the support for the mast underneath the body of the cart. In a steady breeze this cart spins nicely along the roads.



Wind Propeller

Never change a single ball in a bearing. Renew them all.

How to Construct an Annunciator

Oftentimes a single electric bell may be connected in a circuit so that it can be operated from more than one push button. These push buttons are usually located in entirely different parts of the building and it is necessary to have some means of determining the particular push button that was pressed and caused the bell to operate. The electric annunciator is a device that will indicate or record the various calls or signals that may be sent over the circuits to which the annunciator is connected. A very simple and inexpensive annunciator may be made in the following way:

Before taking up the construction of the annunciator it would be best to make a diagrammatic drawing of the circuit in which the annunciator is to operate. The simplest circuit that will require an annunciator is one where the bell may be operated from either of two push buttons. In this case the annunciator must be constructed to give only two indications. Fig. 1 shows how the various elements of such a circuit may be connected. B is an ordinary vibrating electric bell, M1 and M2 are the two electromagnets of the annunciator, A is a battery of several dry cells, and P1 and P2 are the push buttons from either of which the bell may be operated.

When the push button P1 is pressed the circuit is completed through the winding of the magnet M1 and its core becomes magnetized. In a similar manner the core of the magnet M2 becomes magnetized when the push button P2 is pressed and the circuit completed through the winding of the magnet M2.

If an iron armature, that is supported by a shaft through its center and properly balanced, be placed near the ends of the cores of M1 and M2, as shown in Fig. 2, it may assume the position indicated by either the full or dotted lines, depending upon which of the magnets, M1 or M2, was last magnetized. The position of this armature will serve to indicate the push button from which the bell was operated. The magnets should be placed inside a case and the indication may be made by a pointer attached to the shaft, supporting the armature.

If you are able to secure the electromagnets from a discarded electric bell they will work fine for the magnets M1 and M2. They should be disconnected from their iron support and mounted upon some non-magnetic material, such as brass or copper, making the distance between their centers as small as possible. The piece of metal upon which the magnets are mounted should now be fastened, by means of two wood screws, to the back of the board, shown in Fig. 6, that is to form the face of the annunciator. It should be about ⅛ in. thick, ½ in. wide and long enough to extend a short distance beyond the cores of the magnets M1 and M2. Drill a 1/16-in. hole through its center, as shown in Fig. 2. Drive a piece of steel rod into this hole, making sure the rod will not turn easily in the opening, and allow about ½ in. of the rod to project on one side, and 1½ in. on the other side.

Drill a hole in the board upon which the magnets are mounted so that when the long end of the rod carrying the armature is passed through the hole, the armature will be a little more than 1/16 in. from each magnet core. The short end of the rod should be supported by means of a piece of strip brass bent into the form shown in Fig. 3.

Drill a hole in the center of this piece, so the rod will pass through it. When the armature has been put in its proper place, fasten this strip to the board with two small wood screws. You may experience some difficulty in locating the hole in the board for the rod, and it no doubt would be best to drill this hole first and fasten the magnets in place afterwards.

Two small collars should be fastened to the rod to prevent its moving end-

wise. Fit the collars tightly on the rod to hold them in place.

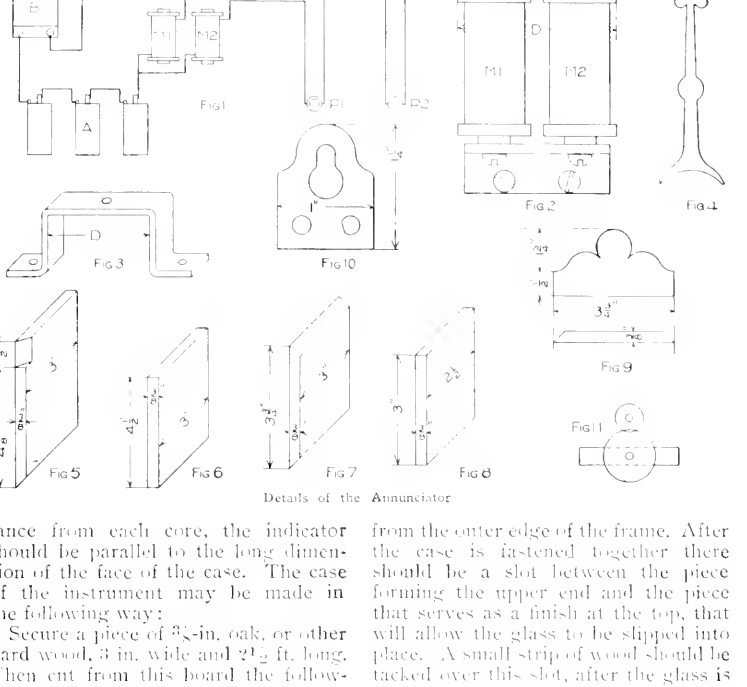
Cut the long end of the rod off so it projects through the face of the annunciator about ⅜ in. Take some very thin sheet brass and cut out a needle or indicator as shown in Fig. 1. In a small piece of brass drill a hole so it will fit tight on the other end of the rod. Solder the indicator to this piece and force it in place on the end of the rod.

When the armature is the same distance from each core, the indicator should be parallel to the long dimension of the face of the case. The case of the instrument may be made in the following way:

Secure a piece of ⅞-in. oak, or other hard wood, 3 in. wide and 2½ ft. long. Then cut from this board the following pieces: two whose dimensions correspond to those of Fig. 5 and are to form the sides of the case; two whose dimensions correspond to those of Fig. 6 and are to form the back and the face of the case; three whose dimensions correspond to those of Figs. 7, 8, and 9 and are to form the lower and upper end of the case and the finish for the top.

Secure a piece of window glass, 1½ in. by 3⅛ in. that is to be used as the front. Before assembling the case cut on the inner surface of the pieces forming the sides and the lower end, a groove just wide enough to take the glass and 1/16 in. in depth. The outer edge of this groove should be ⅜ in. from the outer edge of the frame. After the case is fastened together there should be a slot between the piece forming the upper end and the piece that serves as a finish at the top, that will allow the glass to be slipped into place. A small strip of wood should be tacked over this slot, after the glass is put in place, to prevent the dust and dirt from falling down inside of the case.

The piece upon which the works are to be mounted may be fastened in place



Details of the Annunciator

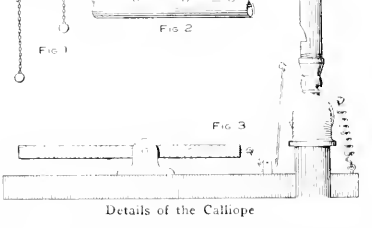
by means of four round-headed brass screws that pass through the sides of the case. It should be fastened about ½ in. back of the glass front. The back may be fastened inside of the case in a similar manner.

Cut two pieces, from some sheet brass, whose dimensions correspond to those of Fig. 10. These pieces are to be used in supporting the case by means of some small screws. Fasten three binding-posts, that are to form the terminals of the annunciator, on the top of the upper end of the case. Mark one of these binding-posts C and the other two L1 and L2. Connect one terminal of each of the magnet windings to the post marked C and the other terminal to the posts L1 and L2. You can finish the case in any style you may desire. Oftentimes it is desirable to have it correspond to the finish of the woodwork of the room in which it is to be placed. The distance the point of the indicator will move through depends upon the distance between the cores of the magnets and the distance of the armature from these cores. These distances are oftentimes such that the indications of the cell are not very definite. If the armature is moved too far from the cores there is not sufficient pull exerted by them when magnetized, to cause the position of the armature to change.

Mount on the shaft carrying the armature a small gear wheel. Arrange another smaller gear to engage this on and fasten the indicator to the shaft of the smaller gear. Any movement now of the armature shaft will result in a relative large movement of the indicator shaft. Figure 11 shows the arrangement of the gears just described.

How to Make a Steam Calliope

Secure ten gas jet valves, the part of the gas fixture shown in Fig. 1, and prepare to place them in a piece of 1-in. pipe, 12 in. long. This is done by drilling and tapping 10 holes, each



Details of the Calliope

1 in. apart, in a straight line along the pipe. The valves screwed into these holes appear as shown in Fig. 2. The whistles are made from pipe of a diameter that will fit the valves. No dimensions can be given for the exact lengths of these pipes as they must be tried out to get the tone. Cut ten pieces of this pipe, each one of a different length, similar to the pipes on a pipe organ. Cut a thread on both ends, put a cap on the end intended for the top, and fit a plug in the other end. The plug must have a small portion of its side filed out, and a notch cut in the side of the pipe with its horizontal edge level with the top of the plug. This part of each whistle is made similar to making a bark whistle on a green stick of willow. The pipes are then screwed into the valves.

The whistles may be toned by trying out and cutting off pieces of the pipe, or by filling the top end with a little melted lead. The 1-in. pipe must have a cap screwed on one end and the other attached to a steam pipe. The steam may be supplied by using an old range boiler, placed horizontally in a fireplace made of brick or sheet iron. If such a boiler is used, a small safety valve should be attached. The keys and valve operation are shown in Fig. 3. This is so plainly illustrated that it needs no explanation.—Contributed by Herbert Hahn, Chicago.

Mechanics for Young America

Home-Made Snowshoes

Secure four light barrel staves and sandpaper the outsides smooth. Take two old shoes that are extra large and cut off the tops and heels so as to leave only the toe covering fastened to the sole. Purchase two long book straps and cut them in two in the middle and fasten the ends on the toe covering as shown in Fig. 1. The straps are used to attach the snowshoe to the regular shoe. When buckling up the straps be sure to leave them loose enough for the foot to work freely, Fig. 2. Fasten the barrel staves in pairs leaving a space of 4 in. between them, as shown in Fig. 3, with thin strips of wood. Nail the old shoe soles to crosspieces placed one-

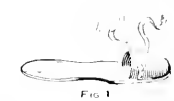


FIG. 1

FIG. 2

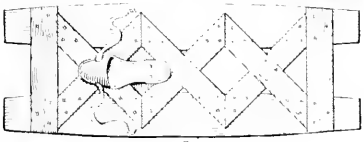


FIG. 3

Made from Barrel Staves

third of the way from one end as shown. —Contributed by David Brown, Kansas City, Mo.

A Velocipede Racer

The small boy shown in the accompanying illustration found a way to make a new plaything out of his old one. When he became tired of his old-fashioned velocipede and thought he would prefer a "racing automobile" he simply disconnected the front wheel and the fork from the rear wheels by removing the bolt. The back part of the machine was turned upside down

Racing Auto

and the bolt replaced to join the two parts. The saddle, which had been previously removed, was then attached to the rear axle with a piece of wire and the "racer" was ready for use.—Contributed by C. L. Edholm, Los Angeles, California.

A Substitute for a Compass

An easy way to make a pencil compass when one is not at hand, is to take a knife with two blades at one end, open one to the full extent and the other only one-half way. Stick the point end of the full open blade into the side of a lead pencil and use the half-open blade as the center leg of the compass. Turn

Pencil on the Knife Blade

with the knife handle to make the circle. —Contributed by E. E. Gold, Jr., Victor, Colo.

Glass Blowing and Forming

Fortunate indeed is the boy who receives a stock of glass tubing, a Bunsen burner, a blowpipe, and some charcoal for a gift, for he has a great deal of fun in store for himself. Glass blowing is a useful art to understand, if the study of either chemistry or physics is to be taken up, because much apparatus can be made at home. And for itself alone, the forming of glass into various shapes has not only a good deal of pleasure in it, but it trains the hands and the eye.

Glass, ordinarily brittle and hard, becomes soft and pliable under heat. When subjected to the action of a flame until dull red, it bends as if made of putty; heated to a bright yellow, it is so soft that it may be blown, pulled, pushed or worked into any shape desired. Hence the necessity for a Bunsen burner, a device preferred to all others for this work, because it gives the hottest flame without soot or dirt. The Bunsen burner, as shown in Fig. 1, is attached to any gas bracket with a rubber tube, but the flame is blue, instead of yellow, as the burner introduces air at its base, which mixes with the gas and so produces an almost perfect combustion, instead of the partial combustion which results in the ordinary yellow flame. All gas stoves have Bunsen burners, and many oil stoves.

If gas is not available, an alcohol lamp with a large wick will do almost as well. The blowpipe, shown in Fig. 2, is merely a tube of brass with the smaller end at right angles to the pipe, and a fine tip to reduce the size of the blast, which is used to direct a small flame. Besides these tools, the glass worker will need some round sticks of charcoal, sharpened like a pencil, as shown in Fig. 3, a file, and several lengths of German glass tubing.

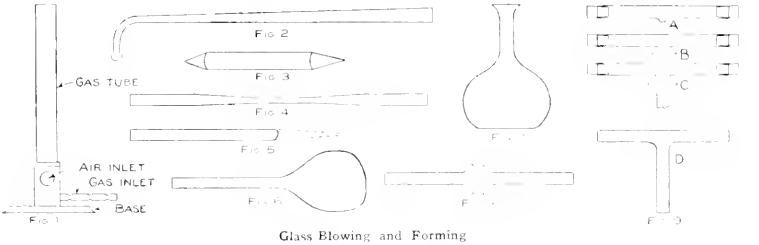
To bend a length of the tubing, let it be assumed for the purpose of making a syphon, it is only necessary to cork one end of the tube and heat it near the top of the Bunsen flame, turning the tubing constantly to make it heat evenly on all sides, until it is a dull red in color. It will then bend of its own weight if held in one hand, but to allow it to do so is to make a flat place in the bend. The heating should be continued until the red color is quite bright, when the open end of the tube is put in the mouth and a little pressure of air made in the tube by blowing. At the same time, the tube is bent, steadily but gently. The compressed air in the tube prevents it from collapsing during the process.

To make a bulb on the end of a tube, one end must be closed. This is easily done by heating as before, and then pulling the tube apart as shown in Fig. 4. The hot glass will draw, just like a piece of taffy, each end tapering to a point. This point on one length is successively heated and pressed toward and into the tube, by means of a piece of charcoal, until the end is not only closed, but as thick as the rest of the tube, as in Fig. 5. An inch or more is now heated white hot, the tube being turned continually to assure even heating and to prevent the hot end from bending down by its own weight. When very hot, a sudden puff into the open end of the tube will expand the hot glass into a bulb, as in Fig. 6. These can be made of considerable size, and, if not too thin, make very good flasks (Fig. 7) for physical experiments. The base of the bulb should be flattened by setting it, still hot, on a flat piece of charcoal, so that it will stand alone.

To weld two lengths of glass tubing together, heat the end of a tube and insert the point of a piece of charcoal in the opening, and twirl it about until the end of the tube has a considerable flare. Do the same to the end of the other tube, which is to be joined to the first, and then, heating both to a dull red, let them touch and press lightly together as in Fig. 8. As soon as they are well in contact, heat the two joined flares together, very hot, and, pulling slightly, the flares will flatten out and the tube be perfectly joined. Tubes

joined without previous flaring have a constricted diameter at the joint.

To make a T-joint in two pieces of tubing, it is necessary to make a hole in the side of one piece, as shown at A in Fig. 9. This is accomplished by the aid of the principle of physics that gases expand when heated. Both ends of the tube, which should be cold, are corked tightly. The whole is then gradually warmed by being held near the flame. When warm, a small flame is directed by the blowpipe from the Bunsen flame to a spot on one side of



Glass Blowing and Forming

the closed tube. As it heats, the air within the tube expands and becomes compressed, and as soon as the hot spot on the side of the tube is soft enough, the confined air blows out, pushing the hot glass aside as it does so, leaving a small puncture. This is to be enlarged with pointed charcoal until it also flares as shown at B. This flare is then connected to the flared end of a straight tube, C, and the T-joint, D, is complete.

Using the blowpipe is not difficult. The lips and cheeks should be puffed out with a mouthful of air, which is ample to blow a flame while the lungs are being refilled. In this way, it is possible to use the blowpipe steadily, and not intermittently, as is necessary if the lungs alone are the "bellows."

Small glass funnels, such as are used in many chemical operations, are made by first forming a bulb, then puncturing the bulb at the top, when hot, with a piece of charcoal, and smoothing down or flaring the edges. Very small and fine glass tubes, such as are used in experiments to demonstrate capillary attraction, water or other liquid rising in them when they are plunged into it, are made by heating as long a section of tubing as can be handled in the flame—2 in. will be found enough—and, when very hot, giving the ends a sudden vigorous pull apart. The tube pulls out and gets smaller and smaller as it does so, until at last it breaks. But the fine thread of glass so made is really a tube, and not a rod, as might be supposed. This can be demonstrated by blowing through it at a gas flame, or by immersing it in colored liquid. The solution will be seen to rise some distance within the tube, the amount depending on the diameter of the tube.

The file is for cutting the glass tubing into lengths convenient to handle. It should be a three-cornered file, of medium fineness, and is used simply to nick the glass at the place it is desired to cut it. The two thumbs are then placed beneath the tube, one on each side of the nick, and the tube bent, as if it were plastic, at the same time pulling the hands apart. The tube will break off squarely at the nick, without difficulty.

The entire outfit may be purchased from any dealer in chemical or physical apparatus, or any druggist will order it. Enough tubing to last many days, the Bunsen burner, blowpipe, file and charcoal should not exceed $2 in cost.

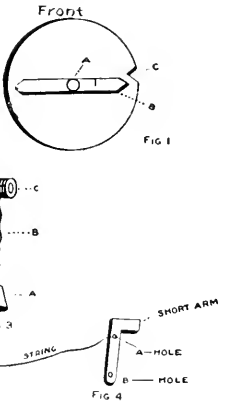
The addition of cadmium to soft solder composed of tin and lead, lowers its melting point and increases its strength.

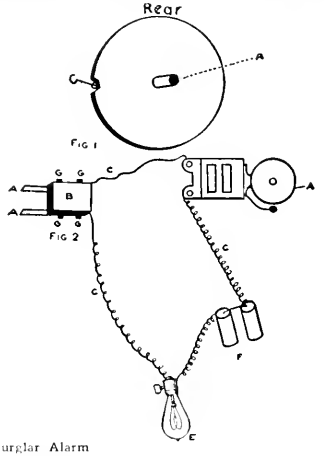
A NOVEL BURGLAR ALARM

Will Ring an Electric Bell, Flash an Electric Light, Shoot a Pistol Four Times and Call the Police

A burglar alarm which will do all of these things may be made at small cost and with very little labor. Secure a piece of hard wood, a part of a tobacco box is best, about 8 or 10 in. square. Cut a round piece like Fig. 1 out of it and on one edge cut a notch as at C. Take a strip of hard wood about 1 in. thick, shape it like B, Fig. 1, and nail it securely to the round piece. At A make a hole large enough to run a 20-penny nail through.

Saw off 3 or 4 in. of the large end of an old baseball bat, make a hole through this also and nail it to the back of Fig. 1. The 20-penny nail should pass through the hole at A, through the hole in the bat, and project far enough to drive into the wall. It should be fastened either to the wall in the room or the back hall.





Construction of Unusual Burglar Alarm

Figure 3 consists of a piece of ball bat, C, fastened to a strong cord, B, which has a weight, A, fastened to the other end. This is to be wound up on the piece of bat, C.

Shape a piece of wood like Fig. 4, about 6 in. long. Make two holes A and B in it. The short arm of this piece is to project over the end of B, Fig. 1, and act as a trigger to keep the weight, A, Fig. 3, from dropping until wanted. The lower end of Fig. 4 is to be securely fastened to a piece of wood projecting from the wall so the short arm will slip over the end of B, Fig. 1. Now fasten a string in the hole, A, Fig. 1, and run the string to the doors and windows. You can run a dozen or more strings to the hole, A. The best way is to put a hook, or eye, in the door facing on one side of the door and a hook on the other side. Make a short hook out of a piece of hay wire and attach it to the end of the string. At night hook the end of string attached to trigger in eye on one side of door facing, draw it in front of door and put through the eye on other door facing. Leave the screen or other door unlocked and if any one attempts to go through the door he will put the machinery to work and get a "warm reception." The string should be about 2 ft. above the floor.

Remove the trigger guard from a

double-acting cheap revolver, and fasten it so when the weight, A, runs down, the piece, B, Fig. 1, will strike the trigger and fire the pistol. *Blank* cartridges *only* should be used. They will prove effectual as the burglar will hardly stop to investigate.

Take a small block of wood, B, Fig. 2, and fasten two springs on it so that they will nearly touch. Fasten this block of wood so when the weight is wound up the springs will be in the notch, C, Fig. 1. When the weight falls the springs will be pressed together, thus ringing the electric bell and furnishing an electric light. If you have no electric lights in the house, get a small electric hand lantern. The bell and light may both be connected on the same circuit. Fig. 2 shows how this is done: A A, are the springs; B, block of wood; C C C C, wires; D, bell; E, lamp; F, batteries; G G G G, screws to which the wires are attached.

Now in addition, if you want to call the police, get a small, cheap phonograph and a record with "Police," "Fire," "Murder," or anything else on it you wish. Make anything you please on it. Place it directly in front of your telephone transmitter and connect it with Fig. 1, and also connect the receiver of the phone with Fig. 1, so that when the weight falls it will start the phonograph and at the same time will drop the receiver off its hook, consequently calling the police. Any one with a little ingenuity can connect the phonograph, and the receiver of the telephone so that when the weight falls they will do their part.

It will cost very little to make this and it will prove a sure protection. If you wish you can leave off calling the police, ringing the bell and flashing the light and only have it fire the pistol.

Loosening Salt in a Shaker

If a common salt shaker is filled to the top, the salt sometimes becomes damp and so closely packed that it can not be shaken through the perforated cap. This can be remedied by placing a piece of non-corrosive metal or hardwood in the center of the shaker and attaching a small thumbpiece on the end through the center hole of the shaker cap. The upright is provided with two cross-pins at the bottom, two at the center, and one at the top, close to the holes in the metal cap. The salt

For Loosening Salt

can be loosened by rotating the upright with the thumbpiece.

Keeping Matches Dry

The camper knows how difficult it is to keep a supply of matches dry. I have found the following very simple process to be invaluable in such cases. Take some paraffin and melt it in a shallow pan in a water bath. Immerse the ordinary friction matches in it for an instant, withdraw, allow to cool, and the matches will have a thin coat of paraffin which protects them from water. I have left a match so protected in a basin of water for half a day and then lighted it by striking in the usual way.—Contributed by Arvid W. Anderson, Omaha, Nebr.

How to Repair Tungsten Lamps

Turn the lamp into a socket which is attached to a flexible cord, switch on the current, and hold the lamp so that you can see the broken ends inside of the glass. Gently shake the globe so the ends will come in contact. This will cause the lamp to light and the ends will often fuse together.—Contributed by R. L. Small, Detroit, Mich.

A crumpled wire may be quickly straightened by catching one end in a vise and giving the other several hard jerks, using pliers to hold the wire

TELEGRAPH CODES.

MORSE, USED IN THE UNITED STATES AND CANADA.
CONTINENTAL, USED IN EUROPE AND ELSEWHERE
PHILLIPS USED IN THE UNITED STATES FOR "PRESS" WORK.

Dash = 2 dots. Long dash = 4 dots
Space between elements of a letter = 1 dot
Space between letters of a word = 2 dots
Interval in spaced letters = 2 dots
Space between words = 3 dots

LETTERS

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B	—···	—···
C	—·—·	—·—··
D	—··	—··
E	·	·
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PUNCTUATION, ETC.

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Fraction line		
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' Apostrophe		·————·—
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[ ] Brackets		—·——·—·
" " Quotation marks		·—··—·

PHILLIPS

. Period	··—·—·
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; Semicolon	·····
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! Exclamation	———·
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¢ Cents	·—·—
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Quotation within a quotation " ' "	·————·——·—·——·—·—

ABBREVIATIONS IN COMMON USE

MIN. Minute	SIG. Signature.	CO. Company.	TW. To-morrow
MSGR. Messenger	PD. Paid	DH Deadhead	TGM. Telegram.
MSK. Mistake	QK Quick.	EX. Express	TKT. Ticket.
NO. Number.	GBA-Give better address	FRT. Freight.	RC. Receive
NTG. Nothing	BN. Been	FR. From	ML. Mail
N.M. No more	BAT. Battery.	GA. Go Ahead	LAT. Latitude.
O.K. All right	BBL. Barrel.	P.O. Post Office	DEG. Degree.
OFS. Office	COL. Collect.	RPT. Repeat	AN. Answer
OPR. Operator.	CK. Check	HQRS. Headquarters	EXA. Extra

How to Make a Cruising Catamaran

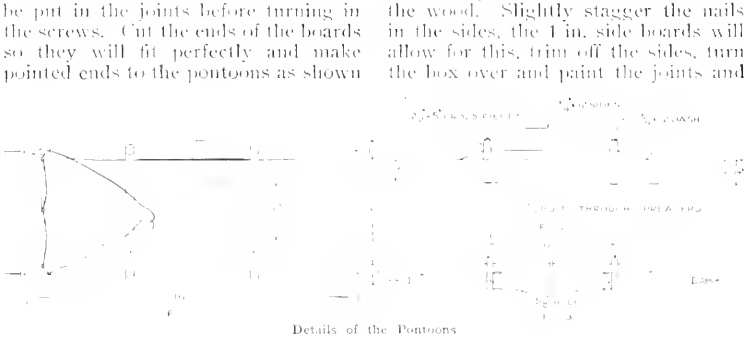
A launch is much safer than a sailing boat, yet there is not the real sport to be derived from it as in sailing. Herein is given a description of a sailing catamaran especially adapted for those who desire to sail and have a safe craft. The main part of the craft is made from two boats or pontoons with watertight tops, bottoms and sides and fixed at a certain distance apart with a platform on top for the passengers. Such a craft cannot be capsized easily, and, as the pontoons are watertight, it will weather almost any rough water. If the craft is intended for rough waters, care must be taken to make the platform pliable yet stiff and as narrow as convenient to take care of the rocking movements.

This catamaran has been designed to simplify the construction, and, if a larger size than the dimensions shown in Fig. 1 is desired, the pontoons may be made longer by using two boards end to end and putting battens on the inside over the joint. Each pontoon is made of two boards 1 in. thick, 14 in. wide and 16 ft. long, dressed and cut to the shape shown in Fig. 2. Spreaders are cut from 2-in. planks, 10 in. wide and 12 in. long, and placed 6 ft. apart between the board sides and fastened with screws. White lead should be put in the joints before turning in the screws. Cut the ends of the boards so they will fit perfectly and make pointed ends to the pontoons as shown in Fig. 3, and fit in a wedge shaped piece; white lead the joints and fasten well with screws.

Turn this shell upside down and lay a board $\frac{1}{2}$ in. thick, 12 in. wide and 16 ft. long on the edges of the sides, mark

Completed Boat

on the under side the outside line of the shell and cut to shape roughly. See that the spreaders and sides fit true all over, then put white lead on the joint and nail with $1\frac{3}{4}$-in. finishing nails as close as possible without weakening the wood. Slightly stagger the nails in the sides, the 1 in. side boards will allow for this, trim off the sides, turn the box over and paint the joints and

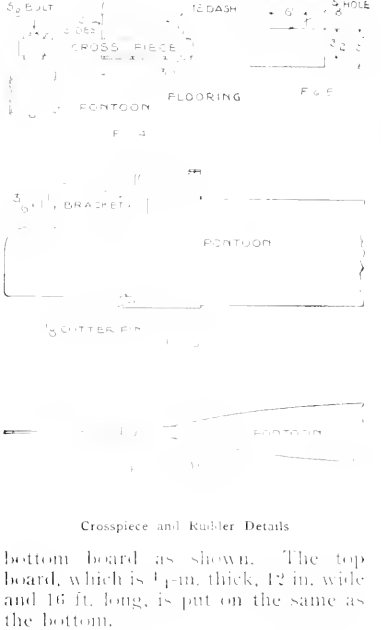


Details of the Pontoons

ends of the spreaders, giving them two or three coats and let them dry.

Try each compartment for leaks by

turning water in them one at a time. Bore a $\frac{5}{8}$-in. hole through each spreader in the center and through the



Crosspiece and Rudder Details

bottom board as shown. The top board, which is $\frac{1}{4}$-in. thick, 12 in. wide and 16 ft. long, is put on the same as the bottom.

After finishing both pontoons in this way place them parallel. A block of wood is fastened on top of each pontoon and exactly over each spreader on which to bolt the crosspieces as shown in Fig. 1. Each block is cut to the shape and with the dimensions shown in Fig. 5.

The crosspieces are made from hickory or ash and each piece is $2\frac{1}{2}$ in. thick, 5 in. wide and $6\frac{1}{2}$ ft. long. Bore a $\frac{5}{8}$-in. hole 3 in. from each end through the 5-in. way of the wood. Take maple flooring $\frac{3}{4}$ in. thick, 6 in. wide, $54\frac{1}{2}$ in. long and fasten with large screws and washers to the crosspieces and put battens across every 18 in. Turn the flooring and crosspieces upside down and fasten to the pontoons with long $\frac{5}{8}$-in. bolts put through the spreaders. Put a washer on the head of each bolt and run them through from the under side. Place a thick rubber washer under and on top of each crosspiece at the ends as shown in Fig. 1. This will make a rigid yet flexible joint for rough waters. The flooring being placed on the under side of the crosspieces makes it possible to get the sail boom very low. The sides put on and well fastened will greatly assist in stiffening the platform and help it to stand the racking strains. These sides will also keep the water and spray out and much more so if a 12-in. dash is put on in front on top of the crosspiece.

The rudders are made as shown in Fig. 6, by using an iron rod $\frac{5}{8}$ in. in diameter and 2 ft. long for the bearing of each. This rod is split with a hacksaw for 7 in. of its length and a sheet metal plate 3/32 in. thick, 6 in. wide, and 12 in. long inserted and riveted in the split. This will allow $3\frac{1}{4}$ in. of the iron rod to project from the bottom edge of the metal through which a hole is drilled for a cotter pin. The bottom bracket is made from stake iron bent in the shape of a U as shown, the rudder bearing passing through a hole drilled in the upper leg and resting on the lower. Slip the top bracket on and then bend the top end of the bearing rod at an angle as shown in both Figs. 6 and 7. Connect the two bent ends with a crosspiece which has a hole drilled in its center to fasten a rope as shown in Fig. 1.

Attach the mast to the front crosspiece, also bowsprit, bracing them both to the pontoons. A set of sails having about 300 sq. ft. of area will be about right for racing. Two sails, main and fore, of about 175 to 200 sq. ft. will be sufficient for cruising.—Contributed by J. Appleton, Des Moines, Iowa.

Rough alligator finished photograph mounts will not receive a good impression from a die. If a carbon paper is placed on the mounts before making the impression, a good clear imprint will be the result.

How to Train a Dog

C. H. Claudy

He's a good dog, a nice dog, we'll admit at the outset, but he doesn't know much about minding you, does he? He'll come when you call him, because he knows your voice and loves you, but he won't go when you send him. He cannot understand why you don't want him! As to fetching or carrying, or guarding, or lying down, or rolling over, or "playing dead," or standing up and begging, or carrying a message or anything like that—

"Well, he never was taught those things!" you say, indignantly.

But if, when you grew up, you couldn't read nor write nor talk, and some one said of you in defense, "Well, he never was taught those things!" in that same indignant tone, on whom would the reflection be, you or your parents?

It is an easy matter to teach a dog almost anything. There is only one principle to master. A dog's mind responds to the elementary moral law of reward and punishment. But, just as you don't expect your mother to punish your baby sister when she flings her rattle and breaks something, so you mustn't punish a pup for doing something he doesn't know is wrong, or failing to do something which he hasn't mastered. Punishment should be rare, and only for disobedience, never for failure to understand. That is the whole thing in a nutshell.

For instance, your dog, just past the wobbly leg stage of puppyhood, will take anything in his mouth which he can get in it, along with a good many things which look entirely too big for mastication. Again, he will run after anything that moves, a ball, a stick, a stone. He has in his mind the desire to do the first half of the act of fetching. All you have to do is to get into his head the other half, the idea that what he runs after and picks up must be brought to you.

To do this requires some stout cord, a collar, some stale bread soaked in gravy, a soft ball made of rags wound rather loosely with string, a little time every day, and a whole lot of patience and good nature.

Fasten the collar on the dog and the string to the collar. Roll the ball away and let the pup have his head. He'll chase it and mouth it—and drop it!

Get the ball yourself, and roll it again, saying, "Fetch it, Dan!" (or whatever his name is.)

Let him have his head again. When he picks the ball up in his mouth, give a gentle pull on the string. The chances are a hundred to one he'll drop the ball again. But the mere repetition of the rolling ball, the words, "Fetch it, Dan," and the pulling of the string will, repeated day after day, make an impression. Some day the ball will either stay in Dan's mouth when he brings up at the end of the cord and returns to you, because his teeth have caught on the twine wound around the ball, or he will turn towards you with it in his mouth before the pull on the cord reminds him. Then, bread and gravy in quantities!

It may be several days before this happens again, or it may be in the next five minutes. Some dogs learn much more quickly, and much younger, than other dogs. Thus, a fox terrier gets his first growth long before a mastiff, and so can be taught earlier. But it will happen again, and the constant commands, cord pullings, and gravy rewards will accomplish their purpose. Dan will learn that for some inscrutable reason, when that ball stays in his mouth until you take it out, bread and gravy results! And, once this is learned, a pat and a kind word satisfy him in place of the gravy!

The dog who answers to his name and can fetch for you can be taught anything. He has learned that reward follows certain things he does. Never let him forget it. Always reward the mastery of a new trick with something to eat, the performance of an old one with a pat and a word, and use the

whip only for disobedience, and then, sparingly.

It is undeniable that a dog can be taught more quickly by fear than by patience, but more is sacrificed than is gained. You would not care to have a dog whose tail went between his legs every time he saw you coming, would you? Hardly. The hearty, doggish greeting, the barks and yelps of welcome, are worth more than the little patience you must use to teach him without the whip. So, when you get to the point where you want Dan to stand on his hind legs and beg, don't follow the advice of some books and whip his fore legs, "sting them," as one book puts it, until he raises them. The better way is to put him in position with his paws resting on a ledge, a stool, a table or step, until he will take the position at the word of command, and then teach him again, making him use but one forepaw as a support, and yet again, with that paw in your hand, and finally, by gently balancing him yourself and letting go that paw, to stand alone, or "beg," as the command usually goes. And, as you love your dog, don't keep him sitting or "begging" too long, especially at first, for his muscles will tire and ache at unaccustomed positions and exercises, just as will yours. And his frame isn't made to be supported that way in comfort for long, any more than you could be comfortable for more than a minute hanging by your hands.

Teaching Dan to lie down when he is told is merely a matter of the command, followed by pressing him to the earth and holding him there until you say, "Get up." The practice, borrowed from trainers of heavier animals, of roping a dog's front foot and throwing him, should never be used. The gentle means is just as good.

Teaching him to roll over is the same—*roll* him over when you tell him to roll until he rolls himself, and "playing dead" is but instructing him, by the same means, to lie on his back, all four legs up in the air, and motionless.

Learning to "guard" is but a doubling of "fetch it" and "lie down." If, lying down, he drops the object, put it between his paws. After a while, *he* will put it there. Then go off and leave him for short periods, and don't let him get up and walk off until you reappear and tell him he may. A dog has so much intelligence, once it is started, that it won't take the idea long to get into his head that this lying down business, with a ball between his paws, means something. He may never know *what* it means, but he won't question it further than to know that he is doing what you want.

Finally, get some one else to take the ball away. If this can be done, it is your turn to come and ask Dan for it, and turn away from him. He won't like it, and he'll try to find out why. Tried again, immediately, and the same result may occur, but some time, and soon, he who tries to take that ball away will be met with a growl—and the lesson is learned.

It is a pleasant pastime, teaching a dog, and the boy who can do it, and at the end of a month has some tricks to show, an unused whip, and a dog which still worships him, is a pretty good sort of a boy—the sort of a boy a dog likes to have as master!

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Card Trick, Mechanical
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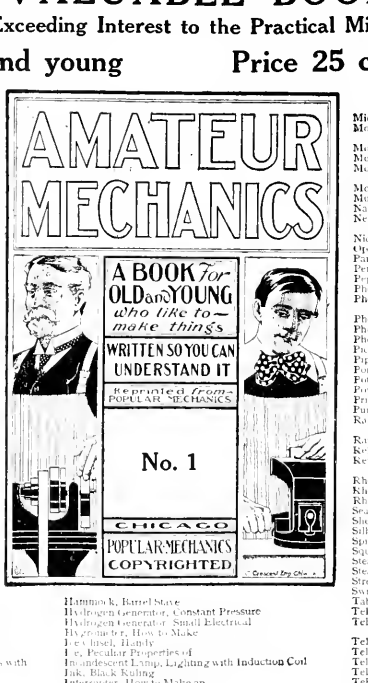

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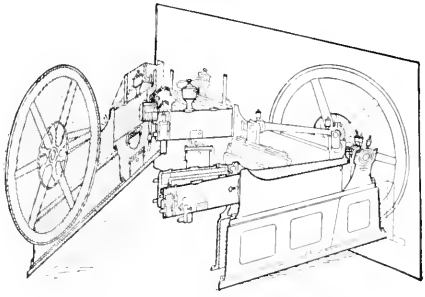

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